

UNITED STATES OF AMERICA.
WAR DEPARTMENT.

MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

JANUARY, 1887.

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List of merchant marine steam and sailing vessels from which International Simultaneous Meteorological reports were received at the Office of the Chief Signal Officer, U. S. Army, Washington, D. C. in time to be used in the preparation of the Weather Review for the month of January, 1887.

Name of vessel.	Captain.	Name of vessel.	Captain.	Name of vessel.	Captain.
Alfred Line.		Monarch Line.		White Star Line.	
Br. s. s. <i>Columbian</i>	Capt. W. Richardson.	Br. s. s. <i>Amyrian Monarch</i>	Capt. John Sparks.	Belg. s. s. <i>De Ruyter</i>	Capt. J. J. Brasseur.
<i>Hibernian</i>	J. Brown.	<i>Peruvian Monarch</i>	John Harrison.	<i>Jan Mayen</i>	H. Meyer.
<i>Manitoba</i>	W. Dabiel.	<i>Morgan Line.</i>		<i>Pluto de Coninck</i>	E. Smit.
<i>Novo Scotia</i>	H. H. Hughes.	Am. s. s. <i>Eureka</i>	R. B. Quick.	<i>White Star Line.</i>	
<i>Sardinian</i>	W. H. Smith.	National Line.		Br. s. s. <i>Adriatic</i>	H. Parnell.
<i>Scandinavian</i>	John Park.	Br. s. s. <i>Canada</i>	Thos. Foote.	<i>Britannic</i>	H. Perry.
American Line.		<i>Denmark</i>	H. S. Rigby.	<i>Germanic</i>	Benj. Gamble.
Br. s. s. <i>British King</i>	John Kelly.	<i>Egypt</i>	J. Sumner.	<i>Republic</i>	P. J. Irving.
<i>British Prince</i>	E. H. Frost.	<i>England</i>	T. P. Healey.	Wilson Line.	
<i>British Princess</i>	G. H. Dodge.	<i>Erle</i>	J. Robinson.	Br. s. s. <i>Bassano</i>	W. Red.
<i>Indiana</i>	H. W. Sargent.	<i>France</i>	A. D. Hadley.	<i>Duino</i>	J. H. Balet.
<i>Lord Clive</i>	F. Urquhart.	<i>Helvetia</i>	G. Cochrane.	<i>Lepanto</i>	T. M. Irvin.
Anchor Line.		<i>Spain</i>	W. A. Griffiths.	<i>Salerno</i>	B. H. Rogers.
Br. s. s. <i>Bellevue</i>	J. J. Small.	Navigazione Generale Italiana.		<i>Sorrento</i>	J. T. Rogers, R. M.
<i>British Crown</i>	Alfred Smith.	It. s. s. <i>Gottardo</i>	Domenico Viola.	Miscellaneous.	
<i>British Queen</i>	H. Williams.	<i>Independence</i>	P. Pirandello.	Nor. s. s. <i>Amictis</i>	F. M. Helmers.
<i>Calcutta</i>	R. T. Garvie.	<i>Polesvora</i>	Broderick.	Br. s. s. <i>Athens</i>	Ch. Off. Emil Towne.
<i>Cincinnati</i>	A. Campbell.	New York and Cuba Mail S. S. Co.		Span. s. s. <i>Chittagong</i>	Capt. A. McDougal.
<i>Cornwall</i>	Hugh Young.	Am. s. s. <i>Cleveland</i>	F. M. Faircloth.	<i>Elcano</i>	V. de Japiza.
<i>Durham</i>	J. McKeague.	N. Y. <i>Havana & Mexico Mail S. S. Co.</i>		Br. s. s. <i>Elbow</i>	T. Robertson.
<i>Ethiopia</i>	John Wilson.	Am. s. s. <i>City of Alexandria</i>	J. W. Reynolds.	<i>Emiliano</i>	Fernando Bengt.
<i>Olympia</i>	Isaac Swain.	<i>City of Washington</i>	W. M. Rittig.	<i>Flitroy</i>	Henry Gibb.
Atlas Line.		Norfolk German Lloyd Steamship Co.		Am. s. s. <i>Leo</i>	C. J. O'Brien.
Br. s. s. <i>Alfred</i>	— McKay.	Ger. s. s. <i>Alber</i>	H. Christoffers.	<i>Lorenzo D. Baker</i>	Warren F. Wiley.
<i>Andros</i>	T. M. MacKnight.	<i>Donau</i>	H. Supner.	<i>Ludwig Holberg</i>	N. Hauge.
<i>Athos</i>	H. Low.	<i>Kider</i>	H. Helmer.	<i>Madrid</i>	M. Garton.
Donk's S. S. Co. (Limited).		<i>Hohenshausen</i>	A. Kohlmann.	<i>Manuel L. Villaverde</i>	Eladio Parada.
Br. s. s. <i>Ambrus</i>	E. Henson.	<i>Rhein</i>	I. Johns.	<i>Mexico</i>	John Taylor.
British & Foreign.		<i>Rosario</i>	H. Richter.	<i>Navarro</i>	S. de Aldasoro.
Br. s. s. <i>Brooklyn City</i>	W. Pitt.	<i>Travis</i>	W. Willigerod.	<i>Olbers</i>	Her. Lahmeyer.
<i>Edinburgh City</i>	T. H. Gore.	<i>Werra</i>	E. Busch.	<i>Prydian</i>	Moos Perry.
Chile Steamship Company.		<i>Werra</i>	H. Bruns.	<i>Rainbow</i>	J. Vlerck.
Am. s. s. <i>Yosemite</i>	R. C. Platt.	Occidental and Oriental Steamship Co.		<i>Boyer</i>	Jas. Mainland.
Chesapeake Line.		Br. s. s. <i>Oceanic</i>	H. Davison.	<i>Salut Roma</i>	Henry Campbell.
Am. s. s. <i>Louisiana</i>	E. V. Gager.	Ocean Steamship Company.		<i>Saxmundham</i>	T. M. Milne.
Chesapeake Line.		Am. s. s. <i>City of Augusta</i>	J. W. Catharine.	<i>Serra</i>	F. de Lencastre.
Br. s. s. <i>Arctura</i>	W. H. P. Hains.	Oceanic Steamship Company.		<i>Straits of Gibraltar</i>	Ch. Off. W. T. Tomlinson.
<i>Calcutta</i>	Alex. McKay.	Am. s. s. <i>Mariposa</i>	H. N. Hayward.	<i>Vertumnus</i>	Capt. G. E. Cook.
<i>Cathlamet</i>	Henry Walker.	Old Dominion Steamship Company.		<i>Viola</i>	L. Murray.
<i>Calla</i>	M. Murphy.	Am. s. s. <i>Manhattan</i>	Frank Stevens.	Sailing vessels.	
<i>Sumatra</i>	T. Roberts.	Oregon Railway and Navigation Co.		Br. bk. <i>Ada Penn</i>	N. Hocken.
<i>Umbrin</i>	W. McNickau.	Am. s. s. <i>Columbia</i>	Fred Boles.	Am. bk. <i>Arcton</i>	J. W. Cates.
Edward Carr's S. S. Line.		Pacific Coast Steamship Company.		Nor. bk. <i>Artemus</i>	E. K. Moo.
Ger. s. s. <i>Australia</i>	G. Franck.	Am. s. s. <i>City of Chester</i>	E. Polunano.	Ger. bk. <i>Bremerhaven</i>	A. Witte.
<i>Polaria</i>	Johannes Schade.	<i>Orizaba</i>	J. Wallace.	Am. schr. <i>C. B. Church</i>	N. A. Anderson.
<i>Polynia</i>	A. Kuhn.	Pacific Mail Steamship Company.		Br. sp. <i>Chas. S. Whitney</i>	Geo. D. Spicer.
<i>Tasmania</i>	H. W. Frank.	Am. s. s. <i>Acapulco</i>	John N. Ingalls.	<i>City Camp</i>	D. McLeod.
Parma Line.		<i>City of Feking</i>	U. S. Coys.	Am. bk. <i>Daisy Boynton</i>	C. Harding.
Br. s. s. <i>Borderer</i>	F. Manley.	<i>Colon</i>	H. C. Dearborn.	Br. sp. <i>E. J. Spicer</i>	D. Spicer.
<i>John Jenkins</i>	John Jenkins.	<i>San Blas</i>	Chas. C. Lima.	Am. schr. <i>Edward H. Emerson</i>	A. H. Child.
<i>Stockholm City</i>	K. Doyle.	Pyman Line.	Thos Chapman.	Ger. bk. <i>Ethel</i>	W. Siens.
General Trans-Atlantic Steamship Co.		Br. s. s. <i>Netley Abbey</i>	H. N. Vyvyan.	Aust. bk. <i>Errante</i>	A. G. Nicolich.
Fr. s. s. <i>La Bourgogne</i>	E. Franguel.	Quebec Steamship Company.		Am. bk. <i>Friedlander</i>	W. Thompson.
<i>La Bretagne</i>	M. de Jouscelin.	Br. s. s. <i>Orinoco</i>	G. S. Locke.	Ger. sp. <i>Friederike</i>	J. Bellmer.
<i>La Champagne</i>	E. Traub.	Red "D" Line.	J. S. Garvin.	<i>George</i>	T. Tiedken.
<i>La Gascogne</i>	Saintell.	Am. s. s. <i>Philadelphia</i>	Sam. Hess.	<i>Heleas</i>	G. Schults.
<i>La Normandie</i>	G. de Kersabiec.	<i>Valencia</i>	W. Woodrick.	Am. schr. <i>John S. Wood</i>	T. Verbeek.
Great Western S. S. Line.		Red Star Line.		<i>Henry Waddington</i>	W. S. Bernard.
Br. s. s. <i>Dorset</i>	E. Crossman.	Br. s. s. <i>Nederland</i>	W. A. Heynon.	<i>John S. Wood</i>	W. H. Hedges.
<i>Warwick</i>	W. James.	<i>Noordland</i>	A. J. Griffin.	<i>John S. Wood</i>	W. T. Bernard.
Japan Line.		<i>Pennland</i>	H. E. Nickels.	<i>John J. Morse</i>	F. P. Whittier.
Br. s. s. <i>Alaska</i>	Geo. S. Murray.	<i>Rhynland</i>	Rud. Wager.	<i>bg. Jane Adeline</i>	G. W. Cates.
<i>Arizona</i>	S. Brooks.	<i>Switzerland</i>	J. C. Jamison.	<i>bk. Josephine</i>	Chas. Brown.
<i>Nevada</i>	John Douglas.	<i>Wesland</i>	H. Buschmann.	<i>bk. Jos. E. Mor</i>	Aemus Lenhard.
<i>Wisconsin</i>	E. Bentley.	<i>Westernland</i>	J. Ueberweg.	<i>sp. Komander Svend Foy</i>	John Bryde.
<i>Wyoming</i>	C. L. Rigby.	Rotterdam Line.	Com. W. G. Randle.	<i>Am. bk. L. P. Munson</i>	J. A. Smith.
Humboldt American Line.		Dtch. s. s. <i>Leerdam</i>		<i>Ger. bk. Locadia</i>	John Stohf.
Ger. s. s. <i>Gotha</i>	C. Kordell.	<i>P. Caland</i>	Capt. P. Sierendregt.	<i>Am. bk. Levante</i>	G. F. Gerry.
<i>Macavia</i>	O. Pasold.	<i>W. A. Scholten</i>	T. H. Bonjer.	<i>schr. N. Hand</i>	D. C. McIntosh.
<i>Rhodia</i>	H. Vogelwang.	<i>Zaandam</i>	G. Bakker.	<i>Am. bgt. Pearl</i>	R. Beche.
<i>Sicilia</i>	H. Schmidt.	Royal Mail Steamship Co.		<i>Ger. bk. Richard</i>	John E. Zimmor.
<i>Sardinia</i>	C. Ludwig.	Am. s. s. <i>City of Dallas</i>	H. v. d. Zee.	<i>Br. sp. Sapphira</i>	A. von Soggen.
<i>Wieland</i>	C. Heibich.	Royal West India Mail Steamship Co.		<i>Ger. bk. Tuck Sing</i>	G. W. Murray.
Japan Line.		Dtch. s. s. <i>Oranje Nassau</i>		<i>Am. schr. Winnie Lawry</i>	Geo. N. Ryder.
Br. s. s. <i>City of Berlin</i>	Francis S. Land.	<i>State Line.</i>		<i>Light-ship No. 37</i>	A. McRitchie.
<i>City of Chester</i>	A. Lewis.	Br. s. s. <i>State of Georgia</i>		New York Herald Weather Service.	R. Macdonald.
<i>City of Chicago</i>	Fred Watkins.	<i>State of Pennsylvania</i>		Br. s. s. <i>Alone</i>	Andrew Jackson.
Japan Line.		<i>State of Nebraska</i>		<i>Andes</i>	Sanders.
Br. s. s. <i>Newmore</i>	John Inch.	<i>State of Nevada</i>		<i>Angerton</i>	T. M. McKnight.
Largest & Best Steamship Company.		<i>Thingvalle Line.</i>		<i>Caracas</i>	S. M. Orr.
Br. s. s. <i>Beaulieu</i>	C. J. Watson.	<i>Thingvalle</i>		<i>City of Puebla</i>	W. N. Hopkins.
<i>Herschel</i>	G. Braithwait.	<i>Twin Screw Line.</i>		<i>City of Washington</i>	J. Deaton.
<i>Monart</i>	W. Spratt.	<i>Tower Hill</i>		<i>Comal</i>	W. M. Rottig.
<i>Others</i>	Jas. Clark.	<i>Warren Line.</i>		<i>El Paso</i>	F. Bolger.
North Atlantic Line.		Br. s. s. <i>Kansas</i>		<i>Grues</i>	H. S. Quick.
Br. s. s. <i>Bayard</i>	R. Lewis.	<i>Norwegian</i>		<i>Knickerbocker</i>	A. J. Jeffrey.
<i>Island</i>	T. H. Fox.	<i>Walla Ward Line.</i>		<i>Lone Star</i>	F. Kemble.
<i>Norwegian</i>	M. Pitt.	Br. s. s. <i>Camden</i>		<i>Martello</i>	G. W. Mason.
Norfolk Line.				<i>Newport</i>	F. E. Jenkins.
Am. s. s. <i>Rio Grande</i>	J. P. Lewis.			<i>Rugia</i>	W. G. Shackford.
Northwestern & New York S. S. Co.				<i>Sacramento</i>	J. G. Percy.
Br. s. s. <i>Postiac</i>	Ch. Off. R. Blyth.			<i>W. A. Scholten</i>	A. Abers.
<i>Miss. & Dominion S. S. Co.</i>				<i>Wells City</i>	R. S. Thompson.
Br. s. s. <i>Ontario</i>	Capt. W. F. Couch.				G. J. Van.
<i>Sardinia</i>	Jon. Gibson.				T. E. W. S.
<i>Toronto</i>	Jas. McAuley.				
<i>Norwegian</i>	O. J. Lindall.				

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MONTHLY WEATHER REVIEW.

VOL. XV.

WASHINGTON CITY, JANUARY, 1887.

No. 1.

INTRODUCTION.

This REVIEW contains a general summary of the meteorological conditions which prevailed over the United States and Canada during January, 1887, based upon the reports from the regular and voluntary observers of the Signal Service and from co-operating state weather services.

Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i. In tracing the centres of the paths of these storms, data from the reports of one hundred and eighty-three vessels have been used.

The general character of the weather over the north Atlantic Ocean during the month was seasonable, although, in instances, storms of unusual severity were encountered.

The presence of an iceberg to the northeastward of the Banks of Newfoundland on the 30th indicated a seasonable breaking up of the Arctic ice fields, and large quantities of icebergs and field-ice will doubtless move southward over the Banks during February.

On chart i for this month are traced the paths of fourteen areas of low pressure; the average number for January during the past thirteen years being 13.0. The most noteworthy atmospheric disturbances of the month occurred during the prevalence of low area number viii on the 13th and 14th, producing rain, snow, and sleet with high winds on the Lakes and thunder-storms in the south Atlantic states, Florida, and the Ohio Valley. The low area which was central in the Indian Territory and northern Texas on the morning of the 22d was attended on that and the succeeding day by thunder-storms in the Gulf States and very heavy rain in Tennessee and the lower part of the Mississippi Valley, numerous stations in these districts reporting over two inches of precipitation in twenty-four hours.

The mean temperature of the month is below the normal in Dakota, Nebraska, and over the entire eastern half of the country, except along the coast of New England and the middle Atlantic states where it is about normal; the temperature of the western part of the country has been above that of the average January.

With the exception of portions of Georgia and South Carolina, the precipitation of the month is below the normal in all parts of the country lying south of the fortieth parallel; it is also deficient in northern Idaho, northern Montana, Nebraska, Iowa, and northern Michigan.

In the preparation of this REVIEW the following data, received up to February 20, 1887, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and twenty-three Canadian stations, as telegraphed to this office; one hundred and sixty-two monthly journals; one hundred and fifty-seven monthly means from the

former, and twenty-three monthly means from the latter; two hundred and eighty-six monthly registers from voluntary observers; fifty-six monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Alabama, Arkansas, Illinois, Minnesota, Mississippi, Missouri, Nebraska, New England, New Jersey, North Carolina, South Carolina, and Tennessee; and of the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE.

[Expressed in inches and hundredths.]

The distribution of mean pressure for January, 1887, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

Two areas of high pressure appear on chart ii, one covers the southwestern part of Oregon and the northern and central parts of California; within this area the mean pressure of the month varies from 30.16 at Sacramento, California, to 30.19 at Roseburg, Oregon; the second area extends over Georgia and the greater part of South Carolina, Alabama, and northern Florida; within this area the pressure of the month is 30.15 or more. The mean pressure in the south Atlantic states, east Gulf states, Florida, Louisiana, and eastern Texas is 30.10 and above. Two areas of low pressure are shown on chart ii, one extends over the northern plateau region of the Rocky Mountains and exhibits a mean barometric pressure of 29.95 or less; the other covers the state of Michigan, Lake Huron, and the northern and eastern parts of Canada; over these districts the pressure is also 29.95 or less. The highest mean pressure of the month, 30.19, occurred at Roseburg, Oregon, and the lowest, 29.81, at Fort Maginnis, Montana.

The departures from the normal pressure are given in the table of miscellaneous meteorological data, and are also shown on chart iv by lines connecting stations of equal departure. The pressure of the month is normal or slightly above in the south Atlantic states, the Gulf States, Florida, Arizona, California, and southern Oregon, in all other districts of the United States it is largely below the normal. The greatest deficiencies occur in Montana, northern Idaho, and the eastern part of Washington Territory, where the departures range from .20 to .26 below the normal. The deficiencies in the middle slope, Missouri Valley, upper Mississippi valley, and the Lake region are also large, ranging from .07 at La Crosse, Wisconsin, to .14 at several stations on the lower lakes. In the extreme eastern part of Canada the pressure of the month is normal or slightly above; in the Saint Lawrence Valley and New England it averages about .08 below, the departures varying from .05 at Eastport, Maine, to .10 at Boston, Massachusetts.

As compared with the pressure of the preceding month, December, 1886, very large deficiencies occur in all parts of the United States, except in the south Atlantic states, east Gulf states, and on the Pacific slope; in these districts the pressure for January, 1887, coincides with, or is slightly above, that of the preceding month. In the northern plateau region, Mis-

souri Valley, and upper Mississippi valley the pressure averages about .17 below that of December, 1886, and ranges from .14 below at Saint Louis, Missouri, to .23 below at Fort Maginnis, Montana. In the Lake region and the Ohio Valley the deficiencies are also large, averaging about .15

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are given in the table of miscellaneous data. The following are some of the extreme monthly ranges:

Greatest.		Least.	
	Inch.		Inch.
Huron, Dakota	1.84	San Diego, California	0.39
Fort Custer, Montana	1.73	Los Angeles, California	0.44
Valentine, Nebraska	1.66	Fort Grant, Arizona	0.56
Yankton, Dakota	1.66	Key West, Florida	0.56
Mouat Washington, New Hampshire	1.60	Yuma, Arizona	0.59
Alpena, Michigan	1.58	Prescott, Arizona	0.68
Mackinaw City, Michigan	1.56	Fort Apache, Arizona	0.68
La Crosse, Wisconsin	1.56	Fort Thomas, Arizona	0.68

AREAS OF HIGH PRESSURE.

Seven well-defined areas of high pressure have been traced within the limits of the United States. The general movement of these areas was in a southeasterly direction while west of the Mississippi Valley, and in a northeasterly direction while approaching the Atlantic coast from latitudes below 40°; the movement of the areas north of the Lake region being more directly to the east. Chart v exhibits the barometric changes occurring at selected stations, and shows that five decided areas of high pressure passed over the centre of the continent, attended by cold waves, on the 1st, 8th, 16th, 26th, and 30th-31st. These areas of high pressure were generally observed to the east of the Rocky Mountains and to the north of Montana and Dakota, but in some cases they were apparently re-enforced by areas approaching from the Pacific. Chart v exhibits the barometer changes occurring at Portland, Oregon, during the month, it will be seen that the pressure remained high from the 1st to 11th, and that high areas passed over that station on the 16th and 24th. The most decided cold waves of the month, extending over the Southern States, attended the areas of high pressure which were observed in the Northwest on the 1st and 7th, causing the temperature to fall below freezing at New Orleans from the 1st to 4th and on the 10th and 11th. The cold waves occurring after the 8th were less marked in the temperature changes over the Southern States, the temperature not reaching the freezing point at New Orleans after the 11th. The areas of high pressure which extended over the Northwest on the 16th, 26th, and 31st were attended by cold waves which advanced more directly to the eastward, causing the low temperatures which were observed in the eastern portion of the United States on the 19th, 27th, and at the close of the month, respectively.

The following are general descriptions of the more important high areas observed during the month.

I.—The month opened with a high area, bounded by the isobar of 30.8, extending over Dakota, with temperatures ranging from —25° to —41° in eastern Dakota and Minnesota. This area extended southward to the west Gulf coast, causing freezing weather and a dry "norther" throughout Texas and the Southwest. It extended southeasterly during the 2d and was central near Cairo, Illinois, on the morning of the 3d, while the cold wave attending this area had advanced to the Atlantic coast. Freezing weather occurred at stations on the Gulf coast and in northern Florida. After reaching the Mississippi Valley the movement of this high area was to the eastward over the New England and middle Atlantic states during the 4th and 5th. The winds shifted to northeasterly at stations to the south of the centre, and snow and sleet were reported from the Southern States on the morning of the 5th. The barometric pressure decreased slowly with the easterly movement of this area, the pressure being from .10 to .20 inch less at the centre at stations on the Atlantic coast than it was at stations in the upper Missouri

valley when the area was central in that region. The cold wave attending this area of high pressure caused changes in temperature ranging from 20° to 30° in twenty-four hours over the regions east of the Rocky Mountain slope. The greatest change in twenty four being in Iowa, Minnesota, and on the south Atlantic coast on the 2d; and on the New England coast and thence northeastward the temperature fell from 20° to 30° on the 2d and 3d.

II.—This area appeared north of Minnesota and Dakota on the 4th and was re-enforced by an area from the Pacific coast on the 5th, causing the pressure to increase to 30.90 and above at stations north of Montana on the afternoon of the 5th, while an area of low pressure, which was immediately to the south of Colorado on the morning of the same day, had been forced southward over New Mexico and western Texas. On the morning of the 6th the high area was central in eastern Dakota, bounded by the isobar of 30.6, and attended by temperatures ranging from —20° to —40°. The rapid increase of pressure on the eastern slope of the Rocky Mountains attending the southerly movement of this area and the southerly movement of the area of low pressure (traced as number iii) immediately to the south, was apparently forced southward and disappeared under the influence of the area of high pressure. After reaching the lower Missouri valley on the afternoon of the 6th there was an increase of pressure to the northward which transferred the centre of this area to the northwestward over Dakota at midnight of the 7th, after which it moved southward to Texas and thence eastward over the Gulf States, disappearing on the 11th to the east of Florida. The barometric pressure observed near the centre of this area decreased from 30.9, when the centre was north of Montana, to 30.6 in the Missouri Valley, 30.3 in northern Texas, and 30.2 in the east Gulf states. The most marked changes in temperature observed during the transit of this cold wave occurred in the northern Rocky Mountain region on the 5th and 6th, in northern New England and the Saint Lawrence Valley on the 7th and 8th, and in Texas on the 8th; these changes ranging from 20° to 40°. This, and the preceding area, produced the coldest weather experienced during the month in the Southern States and central valleys.

III.—This area appeared north of Montana on the afternoon of the 15th, while a second area extended over the north and central Pacific coast regions. This distribution of pressure continued until the morning of the 16th, after which the two areas united, covering the entire Rocky Mountain region on the morning of the 17th, the bounding isobar of 30.6 including Colorado and the greater portions of Wyoming and Utah. It advanced slowly over the Mississippi Valley, causing a "norther" in the Southwest on the 18th, and attended by freezing weather in the Southern States, and temperatures generally below zero north of the Ohio Valley. The movement was southeasterly from the lower Missouri valley during the 18th, it then passed over the Southern States and off the Atlantic coast during the 18th and 19th, the pressure decreasing as the area moved toward the east, and the isobars extended northeastward along the Atlantic coast. The low temperatures observed in New England on the morning of the 19th, when the area was central off the south Atlantic coast, were probably due to the cold westerly winds attending this area of high pressure in its northern quadrants. On the morning of the 18th the temperature ranged from —13° to 8° at stations in the Lake region, and the isothermal line of 10° extended north-eastward from the Ohio Valley to northern New England, the velocity of the westerly winds ranging from ten to twenty-five miles per hour. The wind continued westerly and the weather was generally clear on the Atlantic coast during the night of the 18th. The minimum temperatures which occurred during the transit of this area were the lowest observed during the month at many points in the Northern States.

IV.—From an examination of chart v it will be seen that an area of high pressure passed over New England on the 22d, causing the temperature to fall 20° to 40° in twenty-four hours. This high area apparently formed quickly north of the Lake

region during the 21st and moved rapidly over New England and off the Atlantic coast, causing no marked changes in temperature at stations south of New England.

V.—This area of high pressure formed on the Pacific coast on the 21st, from which region it moved southeastward over the Gulf of Mexico and thence eastward to the Atlantic, without causing any marked changes in temperature. When it approached the Southern States from the southern Rocky Mountain regions it was attended by heavy rains along the Gulf coast and as far north as Tennessee and North Carolina. These rains were probably due to the sudden fall in temperature caused by the advance of the cold air from the mountain regions, the isothermal lines of 40°, 50°, and 60° over the region of heavy rains, extended approximately north and south. The winds in this region, previous to the heavy rains, had been southerly from the 19th to 23d. The barograms on chart v for the stations Boston, Massachusetts, Saint Paul, Minnesota, and Portland, Oregon, give no marked indications of the movements of this area of high pressure as it passed to the south of these stations, and the pressure decreased during the transit from the Rocky Mountains to the Gulf of Mexico, leaving but a slight trace of its influence in the barograms for New Orleans, Louisiana.

VI.—This area appeared on the Pacific coast on the 24th and is distinctive as the only high area which passed from the Pacific to the Atlantic during the month. It extended from the northern to the southern boundaries of the United States, and its movements may be traced from the four barograms represented on chart v. It appeared at Portland, Oregon, on the 24th, at Saint Paul, Minnesota, on the 26th, New Orleans, Louisiana, on the 27th, and at Boston, Massachusetts, on the 28th, thus crossing the continent in less than four days. The barometer rose at the centre of this area as it crossed the continent and the greatest pressure was observed in Nova Scotia after its centre had passed to the eastward. The movement was slightly to the south of east from latitude 40° on the Pacific coast to northern Texas, and afterwards to the north of east from Texas to Nova Scotia. The fall in temperature was general, but the greatest change in twenty-four hours occurred on the Atlantic coast; in New England the change in twenty-four hours amounted to 35° or 40°.

VII.—The tri daily telegraphic reports of the 28th and 29th indicated the advance of this high area and attending cold wave in the extreme northwest. The pressure continued to increase near the centre of the continent during the 30th and 31st, and at the close of the month it had reached 30.70 at stations north of Dakota, with temperatures ranging from -20° to -36°. Although the centre of this high area remained far to the north at the close of the month, the cold wave attending it had extended southward over Missouri and the Ohio Valley, and eastward over the Lake region by midnight of the 30th, and over the Saint Lawrence Valley and the New England coast during the 31st.

AREAS OF LOW PRESSURE.

Fourteen areas of low pressure appeared within the limits of observation during January. They were generally first observed in the Rocky Mountain region north of Montana and Idaho, and telegraphic reports indicate that seven of the areas traced originated at least as far to the west as the north Pacific coast and to the north of the stations of observation. The direction of movement was to the southeast or south during the transit over the Rocky Mountain regions, easterly between the eastern slope of the Rocky Mountains and the Mississippi Valley, and north of east between the Mississippi Valley and the Atlantic. All low areas crossing the continent reached the coast north of the Middle States, and all passed to the north of the Ohio Valley. One storm is approximately traced as following the general course of the Gulf Stream, and a secondary depression developed on the New England coast, which moved eastward over the Atlantic.

The following table shows the latitude and longitude in which

the centre of each area was first and last observed, and the average hourly movement:

Areas of low pressure.	First observed.		Last observed.		Average velocity of translation in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.....	40 00	106 00	48 00	58 00	22.6
II.....	51 00	108 00	48 00	75 00	30.0
III.....	38 00	103 00	33 00	103 00	21.0
IV.....	33 00	73 00	44 00	59 00	37.0
V.....	50 00	117 00	33 00	107 00	24.0
VI.....	40 00	87 00	47 00	59 00	40.0
VII.....	52 00	109 00	48 00	60 00	42.0
VIII.....	51 00	115 00	43 00	75 00	32.0
VIII ^a	41 30	71 00	43 00	62 00	23.0
IX.....	51 00	102 00	62 00	50 00	38.0
X.....	48 00	111 00	50 00	63 00	51.0
XI.....	49 00	123 00	45 00	65 00	36.0
XII.....	50 00	123 00	44 00	66 00	46.0
XIII.....	53 00	115 00	49 00	85 00	35.0
XIV.....	47 00	109 00	51 00	62 00	43.0

Average rate of movement, 37.0 miles per hour.

Although fourteen areas of low pressure have been traced, it will be seen by examining chart v that the most marked barometric changes occurred near the centre of the continent, in the vicinity of Saint Paul, Minnesota, on the 3d and 4th, from the 10th to 16th, on the 19th and 20th, on the 24th and 25th, and 28th and 29th. From the same chart it will be seen that the areas of low pressure passing over New England were more numerous.

The following are general summaries of the meteorological conditions attending the more important of these areas of low pressure while within the limits of observation:

I and II.—This storm has been previously traced from the Rocky Mountain region to the Atlantic coast during the latter part of December, 1886, and on the morning of January 1, 1887, it was central near the southern New England coast. It passed northeastward, with decreasing pressure at the centre, until the afternoon of the 2d, when the central area had become extended and was bounded by the isobar of 29.3, the stations in the Maritime Provinces being then located in the southwest quadrant of this low area. This storm was followed by a rapid rise in the barometer on the Atlantic coast, the increase of pressure in twenty-four hours ending in the afternoon of January 3d amounting to 1.00 north of New England, and more than 0.50 at stations on the Atlantic coast north of Virginia. This general increase of pressure on the coast was accompanied by a corresponding decrease (low area number ii) on the eastern slope of the Rocky Mountains, due to the advance of an area of low pressure, which followed the general course of the Missouri Valley until it reached the vicinity of Omaha, Nebraska, at midnight of the 3d, when its course changed to the northeast and it passed over the Lake region, attended by general snows in the central valleys and thence eastward to the Atlantic coast.

III.—This area has been previously referred to in the description of areas of high pressure and cold waves. The 10 p. m. weather map of the 4th exhibited a trough of low pressure extending from Colorado northwestward to Washington Territory, with a cold wave apparently crowding southward from British America. The succeeding report indicated a southerly movement of both the low and the high area, and these conditions continued during the 5th, when the pressure had increased 0.50 on the northern slope of the Rocky Mountains, and had decreased 0.40 in the upper Rio Grande valley. The increase of pressure above referred to extended over the middle and southern Rocky Mountain slopes during the 6th, completely replacing this low area. The depression thus forced south was only relatively low, the minimum pressure being but 0.10 below the normal.

IV.—This storm may have originated in the Gulf of Mexico, but it has only been approximately traced along the Atlantic coast during the 5th and 6th. It apparently reached its maximum energy when the centre was near the southern coast of New England on the morning of the 6th, when the weather

map showed a slight depression north of the lower lake region, within which the pressure was increasing. This storm moved northeastward from the New England coast, causing severe gales over the north Atlantic on the 6th and 7th.

V.—This depression originated north of Oregon on the 6th and moved southward over Idaho, Wyoming, and Colorado during the 6th and 7th. It remained almost stationary during the 8th, and on that date disappeared while central over New Mexico. As in the case of number iii, the southerly course of this storm seems to have been caused by an extended area of high pressure which moved from the British possessions southward over the eastern slope of the Rocky Mountains and Mississippi Valley. In the present case the departure from the normal in the area of low pressure exceeded 0.30, while the departures from the normal within the area of high pressure to the northward ranged from 0.50 to 0.60.

VI.—The cold wave which extended southward over Texas during the 8th and 9th was preceded by a trough of low pressure which extended northward from the Gulf to the upper lake region. The cold air from the Rocky Mountain slope moved eastward over the lower Mississippi valley, causing the pressure to increase in the South and resulting in the formation of a cyclonic area, central in the lower Ohio on the morning of the 9th. This storm moved rapidly over the lower lake region and New England during the 9th and 10th, the barometer falling from 30.00 to 28.97 at the centre of this area during its movement from northern Indiana to Sydney, Nova Scotia, where it was central at 10 p. m. of the 10th. General snows attended the movement of this disturbance at stations east of the Mississippi, and as far south as Tennessee and North Carolina, and rains and light snows were reported from the east Gulf states. The winds were moderate in the Lake region and were brisk to high on the Atlantic coast north of Cape Hatteras, after shifting to the northwest.

VII.—This depression appeared in the British possessions north of Montana during the night of the 9th and passed eastward to Lake Superior, where it was central on the 11th. It was attended by light snows in the Lake region, Saint Lawrence Valley, and northern New England, and although the barometer fell below 29.40 when the centre passed over Lake Huron no marked changes in the weather conditions were observed during its easterly movement over the Saint Lawrence Valley and the Maritime Provinces.

VIII.—This depression was observed north of Idaho at 10 p. m. of the 11th. It moved rapidly southeastward, following the course of the Missouri Valley, and including within its limits the eastern slope of the Rocky Mountains from Texas northward to Dakota. Light snows were reported in the northern quadrants on the 12th and 13th, attended by northerly winds and low temperatures, but the weather remained generally fair in the southern quadrants until the centre reached the Mississippi Valley on the morning of the 13th, when the rain-area rapidly extended over the entire area east of the Mississippi and south of the Ohio River, while the snow-area extended over the Northern States to the New England coast by the morning of the 14th. The barometer reached its minimum while the disturbance was central over Lake Erie, when the depression was contracted and elliptical in form, the longer axis being in an east and west direction, bounded by isobars of 29.5, 29.6, and 29.7. The general form of this area while passing over the eastern Rocky Mountain slope was elliptical, with the longer axis pointing in a north and south direction. The central area became more extended during the 14th, and the pressure increased at the centre, while a secondary depression developed on the New England coast which was attended by severe northerly gales. The formation of this secondary depression apparently resulted in a loss of energy and the disappearance of this storm before reaching the Atlantic coast. Its centre was last located as central in western New York.

The following notes from observers are of interest in connection with this storm:

Mackinaw City, Michigan: light snow began at 11.05 a. m. of the 13th; at 11.25 a. m. an easterly gale set in and continued during the day, attaining at 9 p. m. a velocity of forty miles per hour. After midnight the wind backed from east to northeast and continued until 11.40 of the 14th, maximum velocity thirty-eight miles per hour.

Green Bay, Wisconsin: light snow fell during the 13th, accompanied during the afternoon by an easterly gale. On the morning of the 14th the wind blew hard from the northeast, attaining a maximum velocity of thirty-six miles per hour.

Cairo, Illinois: on the 13th the barometer fell rapidly, reading at 3 p. m. 29.84, with brisk to high variable winds, maximum velocity thirty-seven miles per hour from the west. During the storm the Mobile and Ohio Railroad round house was blown down, and the boat "Joe Williams" and several barges were blown ashore at East Cairo, Kentucky.

Smithville, North Carolina: a thunder-storm, with heavy rain, occurred during the night of the 13-14th. From 8 to 9 p. m. of the 14th a southeasterly gale prevailed, maximum velocity thirty-seven miles per hour.

Boston, Massachusetts: snow and heavy rain fell at intervals throughout the 14th, accompanied by a northeasterly gale, which attained at 7 a. m. a velocity of forty-eight miles per hour.

Eastport, Maine: on the 14th light snow began falling at 7.40 a. m.; at 10 a. m. it changed to sleet, and again to light snow at 5.10 p. m. At 6.15 a. m. a northeasterly gale set in, attaining at 3.15 p. m. a velocity of fifty-five miles per hour. During the day the barometer fell rapidly. The snow and gale ended during the morning of the 15th.

IX.—The midnight report of the 14th indicated the presence of a depression north of Dakota. At the following telegraphic report the region of least pressure had shifted westward to the northern Rocky Mountain stations, from which region an extended area of low barometer moved southeastward during the 15th and 16th, reaching the vicinity of Lake Michigan at 10 p. m. of the 16th. This area of low pressure was followed by a rapid increase of pressure and a cold wave over the central valleys. From the Lake region the course of this depression was northeastward, down the Saint Lawrence Valley, attended by severe gales in the south and west quadrants. The barometer fell to 28.82 at Anticosti, Gulf of Saint Lawrence, on the morning of the 18th, when the centre of disturbance was near that station. Gales continued at the northeastern Canadian stations and along the Atlantic coast north of Hatteras on the 17th and until the morning of the 18th.

The following notes relate to this storm:

Grand Haven, Michigan: light snow began falling during the early morning of the 17th and continued without cessation throughout the day, accompanied by high northwesterly winds which blew for a time at the rate of forty miles per hour. The snow drifted badly and all trains were delayed several hours; all local traffic was suspended.

Buffalo, New York: after 3 p. m. of the 16th the barometer began falling rapidly and the wind backed to east and northeast. During the night of the 16-17th the barometer fell four-tenths of an inch, at the same time a decided rise in temperature occurred, with snow. At 5.15 a. m. of the 17th a severe southwesterly gale set in and increased in velocity until 2.50 p. m. when it had attained a velocity of fifty-eight miles per hour; the gale continued until 8.15 a. m. of the 18th. During the 18th the pressure rose rapidly, with falling temperature; minimum, $-1^{\circ}7$.

Mackinaw City, Michigan: the 16th opened with cloudy weather and brisk southeasterly winds, shifting to east and blowing with increased velocity. An easterly gale, average velocity twenty miles per hour, began at 10.50 a. m. and continued until 3.40 a. m. of the 17th; maximum velocity thirty-seven miles per hour. At 10 a. m. of the 17th the wind backed to northwest and blew a gale throughout the day; maximum velocity, thirty miles per hour, at 2.30 p. m. Heavy snow fell from 6 p. m. of the 16th until 2 p. m. of the 17th.

Chincoteague, Virginia: during the 17th the barometer fell rapidly, reaching 29.44 at 3 p. m., after which it rose as rapidly. In the early morning the wind was fresh from the south, becoming brisk at noon, and again fresh until 4 p. m. when it shifted to the northwest and began blowing a gale, reaching at 9 p. m. a maximum velocity of fifty-six miles per hour, and for ten minutes blowing at the rate of sixty-five miles per hour. Heavy rain, with snow at intervals, fell during the night of the 17-18th. The 18th was cold, with brisk to high northwesterly winds prevailing.

Rochester, New York: the barometer fell very rapidly during the night of the 16-17th, reading 29.34 at 7 a. m. of the 17th, with wind from the south and fresh until 10 a. m. when it shifted to west and increased in force, attaining at 11.15 a. m. a velocity of forty-six miles per hour, and at 1.15 p. m. fifty-two miles per hour. On the 18th the wind blew hard from the northwest, with falling temperature and light snow.

Key West, Florida: At 5.13 a. m. of the 18th a strong northerly gale set in and continued throughout the day, attaining at 5.30 a. m. a velocity of thirty-nine miles per hour.

Cedar Keys, Florida: on the 17th the wind blew steadily from the south until 1 p. m. when it increased in force, veering to the west at 5 p. m., and later, to the northwest. At 8.40 p. m. the wind attained the velocity of a gale;

maximum velocity, thirty-two miles per hour from the northwest, at 10.20 p. m. Light rain fell from 6.30 to 7.10 p. m.

X.—Number x was observed in northern Montana on the morning of the 19th; it passed southeastward, following the general course of the preceding storm; the southeasterly movement ended in southern Dakota and the storm passed over the upper lake region on the 22d, developing considerable energy when central near Mackinaw City, Michigan, where the barometer fell to 29.01 on the afternoon of the 20th. It moved northeastward over the Saint Lawrence Valley, causing gales at extreme northeastern stations on the 21st. The central area became greatly extended as it moved to the northeast, but the wind increased in force and the most severe gales reported during the month occurred along the Atlantic coast as this storm passed over that region.

The following notes by Signal Service observers are of interest:

Buffalo, New York: a southwesterly gale set in at 7.30 a. m. of the 20th and continued until 6 a. m. of the 21st; at 9.10 a. m. it reached a velocity of fifty-eight miles per hour. During the storm the ice on the lake was broken up for a distance of about ten miles out, which is a very unusual occurrence for this season.

Mackinaw City, Michigan: a southerly gale, shifting to the southwest, began at 1.45 a. m. of the 20th; during the afternoon the wind shifted to the west, and attained a velocity of thirty-six miles per hour at 7.45 p. m. The barometer fell rapidly until 1.30 p. m. when it stood at 28.97, after 1.30 p. m. it began rising rapidly.

Cairo, Illinois: during the 20th high variable winds prevailed, maximum velocity forty-four miles per hour from the southwest. River men state that this was the strongest wind that has occurred on the river for many years; several barges were torn from their moorings and blown across the river.

XI.—This storm appeared on the north Pacific coast on the afternoon of the 20th, and crossed the continent to the Nova Scotia coast, it being clearly defined and the centre approximately located at each of the tri-daily reports from the date of its appearance until the 10 p. m. report of the 24th, when the centre was located near Eastport, Maine. The course was southeasterly to northern Texas and thence northeastward over the Lake region and New England. The barometric pressure increased at the centre as it passed eastward from the Pacific coast to the Rocky Mountain region. When central in northern Texas three areas of high pressure were shown on the weather charts, one to the north over Manitoba, one on the north Atlantic coast, and the third on the central Pacific coast. An extended trough of low pressure separated the areas of high pressure and covered the region from the upper lake region southwestward to the Rio Grande Valley, within which this low area was enclosed, bounded by isobars of 29.5, 29.6, and 29.7, which were elliptical in form, the longer axis pointing northeastward, the direction afterwards followed by this storm. This general form of this depression continued during its passage to the Saint Lawrence Valley, with slight changes in pressure, until the centre of disturbance reached the coast, when a decided decrease of pressure occurred, the barometer falling below 29.2 at Eastport, Maine, on the afternoon of the 24th. The telegraphic reports for the succeeding twenty-four hours from the northeastern stations are missing, but severe westerly gales continued in this section on the afternoon of the 25th, thus indicating that this depression passed over the Atlantic, attended by severe storms. The precipitation attending this area of low pressure was more marked in the south and east sections of the country, but light rains or snow were reported in all states and territories, except Dakota, during its passage over the country.

XII.—This area approached from the north Pacific and was observed north of Washington Territory on the afternoon of 23d. It crossed the continent in two days and sixteen hours, following approximately the path of the preceding storm, however, not passing as far to the south, on the eastern slope of the Rocky Mountains previous to the change of direction to the northeast, but it passed farther to the north while moving over the Lake region. After reaching the Saint Lawrence Valley it passed over New England to the south of Nova Scotia, following the course of the preceding storm, but exhib-

iting much less energy. During the movement of this area of low pressure to the eastward the barometer fell to 29.50 at stations near the centre in Nebraska, after which the pressure rose and again fell to 29.50 when the centre was passing over Lake Huron. From this point eastward to the Atlantic the pressure at the centre increased.

XIII.—This disturbance also passed from the north Pacific coast, where it was central on the 26th, and from the tri-daily weather charts it may be traced to the north of the upper lake region on the 29th. It was at no time central within the limits of the United States, but was attended by severe gales in the Lake region and general rains or snows over the central valleys, Lake region, and Atlantic States when the centre was near Lake Superior, from which region it apparently moved northeastward and did not reach the coast within the limits of observation.

XIV.—This storm apparently developed during the night of the 28th, over Montana. The depression was elongated and located between two high areas, one to the north of Montana and the other on the central Pacific coast, the longer axis pointing to the southeast. It moved rapidly to southern Minnesota during the succeeding eight hours, the general form continuing but the larger axis pointing to the northeast. This rapid movement to the eastward was apparently due to the union of the two high areas previously referred to. It passed eastward over the Lake region to the Saint Lawrence Valley during the 29th and 30th with increasing energy near the centre of disturbance, but without causing any decided change in the atmospheric conditions south of the Lake region and New England. The minimum barometric pressure (29.21) within this low area occurred at Anticosti, Gulf of Saint Lawrence, on the morning of the 31st. The barometric pressure within the central area decreased slowly during its movement eastward from the Rocky Mountains.

NORTH ATLANTIC STORMS DURING JANUARY, 1887.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the proprietors of the "New York Maritime Register," and from other miscellaneous data received at this office up to February 22, 1887.

Twelve depressions are traced, of which, seven passed northeastward over, or in the vicinity of, Newfoundland; four first appeared over mid-ocean, and one apparently developed off the east coast of the United States. The general course of direction of the depressions was east-northeast to northeast.

A severe storm prevailed over the British Isles during the 6th and 7th, with barometric pressure ranging below 29.00 (736.6) on the latter date. The disturbance occasioned strong gales between the fortieth and sixtieth parallels and east of the twenty-fifth meridian. This depression was probably a continuation of ocean depression number 2 which occupied the ocean northwest of Scotland on the 5th, after which date its course cannot be accurately determined, owing to an absence of reports.

The depression traced as number 1 first appeared off the southeast coast of Greenland on the 2d and passed east to the north of Scotland. Number 2 passed northeast over the southern portion of Newfoundland during the morning of the 3d and moved rapidly northeast to the north of Scotland by the 5th. Number 3 followed a course similar to that pursued by number 2 during the 7th, 8th, and 9th. Number 4 appeared over the ocean west of Ireland on the 10th and moved to the west coast of Scotland by the 11th. Number 5 passed over Newfoundland during the early morning of the 11th and moved rapidly north-

eastward to the north of Scotland by the 13th. Number 6 passed over the central portion of Newfoundland during the early morning of the 13th and disappeared in the direction of the Scotch coast after the 15th.

Number 7 apparently developed off the coast of the United States and is traced northeast from the 15th to the 18th inclusive, after which it disappeared. Number 8 first appeared over mid-ocean on the 16th, and, moving rapidly northeast to the west coast of Scotland, disappeared after the 17th. Number 9 passed over the northern portion of Newfoundland during the early morning of the 22d and moved ene. until noon (Greenwich mean time) of that date, after which it circled southeast and disappeared in the direction of the Spanish coast after the 24th. Number 10 first appeared over mid-ocean on the 24th, and, passing eastward, disappeared in the direction of the Irish coast after the 25th. Number 11 passed northeast over Newfoundland during the early morning of the 25th and moved rapidly north of east until the 26th, after which it disappeared to the northeastward. Number 12 passed south of Newfoundland during the 27th, and, passing rapidly northeast, disappeared over mid-ocean after the 29th.

The month opened with an area of low pressure central in the vicinity of Cape Cod. This depression passed to the south coast of Newfoundland by the night of the 2d, accompanied by rain and fresh to strong gales north of the thirty-fifth parallel. Over mid-ocean the barometric pressure was high from the thirtieth to the fiftieth parallels, while to the eastward of the twenty-fifth meridian the weather was unsettled. During the first decade of the month the passage of four depressions caused a continuation of unsettled weather over the entire ocean. During this period the pressure continued high in the vicinity of the Azores. During the second decade four depressions appeared, and the pressure within the area of high barometer over the Azores, although subject to frequent fluctuations, continued generally high. On the 16th gales of unusual severity occurred over mid-ocean. The severest storms occurred during the third decade of the month. On the 24th gales of hurricane force prevailed over mid-ocean, and strong gales and generally unsettled weather continued until the 31st. The month closed with relatively fair weather over mid-ocean; over the British Isles and the ocean to the twentieth meridian the pressure was low, with rain and fresh to strong gales; an area of low pressure central over Labrador caused rain and fresh west to south gales over, and in the vicinity of, Newfoundland.

For January, 1886, the paths of seven areas of low pressure were traced, of which, two were continuations of low areas which passed over the United States and Canada; one apparently developed off the coast of Florida; one first appeared over mid-ocean, and the tracks of the remaining three were charted near the west and northwest coasts of the British Isles.

The weather over the north Atlantic during January, 1886, was marked by frequent high winds and gales. The pressure over mid-ocean from the beginning of the month to the 18th was generally high, while successive areas of low pressure took their course along the coasts of the United States and Canada, and also over, and in the vicinity of, the British Isles. From the 19th to the close of the month the pressure over mid-ocean and off the European coast was comparatively low. Areas of high pressure occupied the ocean south of the Banks from the 19th to the 22d and from the 25th to the 28th.

As compared with the corresponding month of previous years the weather over the north Atlantic during January, 1887, was unusually severe over mid-ocean during the latter portion of the month. The storms were more numerous than in previous years, and, being rather equally distributed throughout the month, with tracks, as a rule, confined to territory north of the fiftieth parallel, caused a continuation of strong westerly gales in the trans-Atlantic tracks.

The following are brief descriptions of the depressions traced:

1.—This depression first appeared on the 2d in N. 59°, W. 29°, whence it had apparently advanced from the vicinity of

Greenland; from this position the storm-centre moved east to about N. 60°, W. 12° by the 3d, after which it disappeared in the direction of the Norwegian coast. The depression exhibited barometric pressure ranging below 29.00 (736.6), and occasioned fresh to strong gales east of the twenty-fifth meridian and north of the forty-fifth parallel during the 3d.

The following special reports have been rendered relative to this storm:

Capt. N. Hocken, of the barkentine "Ada Peard," reports: "3d, 1 a. m., in N. 49° 45', W. 9° 0', wind shifted from nne. around by the w. to sw. and increased by noon to a violent gale, with hard squalls and heavy rain; gale continued from this quarter for five hours, when it veered to n. and blew a strong gale for fourteen hours, with hard hail squalls, accompanied with lightning." Capt. Edward Bentley, of the s. s. "Wisconsin," reports a whole gale from the 3d to the 6th; wind veered from s. to nw., with very heavy sea and hard squalls of snow and hail; lowest barometer, 28.95 (735.3), at midnight of the 3d, in N. 50° 0', W. 23° 10'. Captain Santelli, of the s. s. "La Gascogne," reports a strong westerly gale on the 3d and 4th; lowest barometer, 29.57 (751.1), at 8 a. m. of the 3d, in N. 49° 42', W. 20° 15'.

The s. s. "Lake Winnipeg" experienced a westerly storm, commencing on the 2d in the Irish Channel and continuing until the 7th; lowest barometer, 29.00 (736.6), at noon of the 3d, in N. 52° 25', W. 7° 18'. Capt. John Taylor, of the s. s. "Mercia," reports a storm on the 3d from sw. veering to nw.; lowest barometer, 29.26 (743.2), at 5 p. m., in N. 50° 0', W. 5° 56'; gale continued from ssw. to nw. until the 6th, with terrific seas. Capt. G. W. Murray, of the ship "Sapphire," reports: "3d, in N. 49° 45', W. 4° 50', barometer 29.44 (747.8), and falling rapidly; 4.30 p. m., wind sw., force 10, heavy rain, and a fearful sea from wsw.; 7.30 p. m., wind moderating, barometer 29.34 (745.2), sea very heavy; 8.30 p. m., wind n., force 9. 4th, noon, barometer 29.24 (742.7), wind sw. by w., force 9; 6 p. m., barometer 28.94 (735.1), wind hauled to wnw, weather bright and clear to nw. During the 5th and 6th the barometer continued very low in the Channel, with generally moderate, variable winds."

2.—This storm was a continuation of land depression number 1, and, passing northeast over Newfoundland, was central on the 3d in N. 50°, W. 49°, whence it moved northeast to N. 60°, W. 10° by the 5th, accompanied during the 4th and 5th by pressure ranging below 29.00 (736.6), rain, and gales of great violence. Subsequent to the 5th the storm-centre apparently passed southeast over the British Isles, where pressure ranging below 29.00 (736.6) was indicated on the 6th and 7th, and hard gales prevailed over the ocean to N. 40° and W. 20° during these dates.

The following reports, descriptive of disturbances encountered within the area of this depression, have been received:

Capt. H. C. von der Zee, of the s. s. "Zaandam," reports a westerly storm from the 4th to the 7th; lowest barometer, 29.22 (742.2), at 1 p. m. of the 5th, in N. 49° 28', W. 13° 6'. The s. s. "Bolivia" had a whole westerly gale from the 4th to the 6th; lowest barometer, 29.02 (737.1), at noon of the 5th, in N. 54° 35', W. 21° 31'. The s. s. "Samaria" encountered a strong gale on the 5th, in Saint George's Channel; lowest barometer, 28.95 (735.3), at 4 a. m. Capt. H. Schmidt, of the s. s. "Slavonia," reports a storm from the 4th to the 6th; wind veered from wnw. to se. during, and to nw. following, the passage of the depression; lowest barometer at noon of the 5th, in N. 57° 25', W. 13° 8'. Capt. M. Fitt, of the s. s. "Virginian," reports a whole gale from the 4th to the 7th; wind veered from ssw. to nw.; lowest barometer, 29.19 (741.4), at 11.24 a. m. of the 6th, in N. 51° 8', W. 11° 32'. Capt. T. Roberts, of the s. s. "Samaria," reports a severe storm during the 6th, with terrific squalls, hail, and lightning, and a tremendous sea. The gale commenced at 2 a. m. on the 5th, with a sudden shift of wind from ssw. to nw., reaching its height at noon of the 6th, in N. 51° 29', W. 11° 55', when it commenced to moderate. Capt. R. P. Moore, of the s. s. "Siberian," reports a moderate

ne. gale from noon of the 7th to 4 a. m. of the 8th; lowest barometer, 28.92 (734.6), at 8 a. m. of the 7th, in N. 55° 20', W. 10° 20'. The gale was attended by heavy squalls.

3.—This storm was a continuation of depression number iv which circled northeast off the coast of the United States during the 5th and 6th. On the morning of the 7th the storm was central on the south coast of Newfoundland, with pressure about 29.60 (751.8), whence it moved northeast to N. 53°, W. 39° by the 8th, with pressure two to three-tenths of an inch lower than on the preceding date; by the 9th the centre of depression had advanced to N. 57°, W. 21°, with central pressure about 29.20 (741.7), after which it passed northeast beyond the region of observation.

As is shown by the following reports, this depression possessed great energy after passing eastward from the Newfoundland coast:

Capt. W. Gleig, of the s. s. "Kansas," reports a fresh gale from the 8th to the 10th; wind veered from se. to nw.; lowest barometer, 29.31 (744.5), at 8 a. m. of the 8th, in N. 49° 38', W. 36° 0'. Capt. H. Campbell, of the s. s. "Lake Winnipeg," reports a storm from the 8th to the 10th; wind veered from ssw. to wnw.; lowest barometer, 29.48 (748.8), at 8 p. m. of the 8th, in N. 52° 0', W. 29° 0'. Capt. T. Roberts, of the s. s. "Samaria," reports a fresh westerly gale from the 9th to the 11th; lowest barometer, 29.44 (747.8), at midnight of the 9th, in N. 49° 30', W. 29° 0'. The gale was accompanied by high seas and terrific snow squalls. Capt. R. P. Moore, of the s. s. "Siberian," reports a fresh westerly gale from the 9th to the 11th; lowest barometer, 29.28 (743.7), at 4 a. m. of the 9th, in N. 53° 52', W. 26° 0'.

4.—This depression apparently developed to the northwestward of the Azores on the 9th, an absence of reports from that region will not, however, admit of accurately locating its centre on that date. By the 10th the storm had advanced rapidly northeast to N. 53° W. 18° where pressure about 29.00 (736.6) was shown; at 12 noon, Greenwich mean time, of the 11th the storm was central off the west coast of Scotland, whence it passed northeast beyond the region of observation.

The following special reports refer to this storm:

Chief Officer Robert Blythe, of the s. s. "Pontiac," Capt. H. W. Brown, commanding, reports: "9th, in N. 40° W. 39°, strong gale and very high sea commenced from ssw.; wind hauled to nnw., then backed to nw.; gale lasted thirty-eight hours, and was obliged to tow oil-bags to prevent sea from breaking on board." Capt. Wm. McMickan, of the s. s. "Umbria," reports a strong gale on the 10th, from sse. veering to nw.; lowest barometer, 29.03 (737.3), at 4 p. m., in N. 51° 10', W. 16° 0'. At noon, with the wind sse. and the barometer falling rapidly, the gale suddenly increased in violence, and a dangerous confused sea was running from s. and w. The ship labored heavily and shipped large quantities of water over all. At Leith, Scotland, on the 11th, the barometer at 6 a. m. stood 29.44 (747.8), at 8.15 a. m. 29.30 (744.2), lowest; wind at 8.15 a. m. sse., force 7½ in squalls, and at 9 a. m. s., 7½ in squalls; at 11 p. m. barometer 29.85 (758.2), rising rapidly.

5.—This storm was a continuation of land depression number vi, and, passing northeast over Newfoundland, was central on the morning of the 11th in N. 51°, W. 48°, with pressure ranging below 29.00 (736.6) and evidence of great energy, whence it moved rapidly northeast to N. 57°, W. 28° on the 12th, with an appreciable increase in central pressure; from this position the storm-centre moved to the north of Scotland by the 13th; thence passing northeast the depression moved beyond the region of observation.

The following reports refer to storms encountered during the passage of this depression:

The s. s. "Rhaetia," Captain Vogelgesang, commanding, experienced a heavy gale on the 10th and 11th; wind veered from se. to n.; lowest barometer, 29.11 (739.4), from 1 a. m. to 4 a. m. of the 11th, in N. 42° 0', W. 62° 51' (at noon). The gale was accompanied by rain and heavy hail and snow squalls, with high cross seas running from the w. and se. The s. s.

"Jeannie" encountered a whole westerly gale on the 10th; lowest barometer, 29.56 (750.8), at 4 a. m., in N. 38° 10', W. 74° 0'. Capt. E. V. Gager, of the s. s. "Louisiana," reports a whole gale on the 10th; wind veered from s. to nw., with heavy rain and high confused sea; lowest barometer, 29.66 (753.4), at 10 a. m., in N. 31° 50', W. 76° 30'. Capt. B. H. Rogers, of the s. s. "Salerno," reports a storm on the 10th; wind veered from se. to wnw.; lowest barometer, 28.88 (733.5), at 10 p. m., in N. 45° 0', W. 51° 25'. The ship "Constance" left Hamburg on December 14, 1886, and had fair weather until January 10, 1887, when in N. 40°, W. 68° a hurricane came up from the nw., accompanied by heavy rain. Suddenly, without warning, the foremast was struck by lightning. It tore the topmast to pieces, broke the yards into kindling wood, and then flying to the mainmast speedily stripped it of rigging. The topmast was smashed to atoms and the mast itself broken off close to the deck but was afterwards braced up. The mizzenmast went overboard in splinters, and there was scarcely a rag of canvas left.

Third Officer D. Thomson, of the s. s. "Richmond Hill," Capt. A. Hyde, commanding, reports a terrific storm, with frequent hail squalls of hurricane force and very high cross sea, on the 11th, in N. 47° 21', W. 44° 35' (at noon); storm at its height at 3 p. m. Capt. H. Parsell, of the s. s. "Adriatic," reports: "11th, a. m., wind backed from nw. to s., increasing, with fierce squalls, to force 11 at noon, with showers of rain and sleet and very heavy sw. sea; p. m., heavy gale, with squalls of hurricane force at short intervals; wind and sea gradually abated after midnight, the wind veering to nw.; lowest barometer 28.96 (735.6); position at noon, N. 48° 14', W. 41° 17'." The s. s. "Siberian" experienced a westerly storm on the 11th and 12th; lowest barometer, 29.02 (737.1), at midnight of the 11th, in N. 50° 32', W. 37° 0'. The s. s. "Bolivia" had a westerly storm during the 11th, with barometric pressure 28.66 (728.0) at 2 p. m., in N. 49° 06', W. 43° 25'.

The s. s. "Leo" experienced a storm during the 11th and 12th; wind veered from s. to wnw.; lowest barometer, 29.39 (746.5), at 10 p. m., in N. 37° 5', W. 58° 0'. Capt. M. R. Thompson, of the s. s. "Horn Head," reports a gale attaining force 11 during the 10th and 11th; wind veered from se. to wnw.; lowest barometer at 6 a. m. of the 11th, in N. 40° 17', W. 53° 0'. "This gale was remarkable for the exceedingly heavy wind that preceded the shift, blowing from 6 to 8 a. m. of the 11th with full hurricane force. During these two hours a dark, compact mass of clouds, giving out brilliant lightning, passed apparently from ssw. to sse., accompanied by torrents of rain. When the clouds had passed the gale broke."

The s. s. "State of Pennsylvania," on the 11th, off the Banks of Newfoundland, in N. 47° 43', W. 45° 0', was struck by a tremendous sea, in the form of a pyramid, which towered above the vessel and came down on the bridge. The skylight of the deck was broken, and tons of water poured into the saloon, where the passengers were at dinner; no one was injured, although considerable damage was done. Previous to encountering the wave the vessel was steering wsw., right in the teeth of the wind, which was blowing fresh. When the sea receded there was a calm for a moment, and then seas rolled in on the vessel, threatening to engulf her. The gale which followed was the worst, Captain Mann states, he has experienced in years. Capt. W. McMickan, of the s. s. "Umbria," reports a whole westerly gale on the 12th; lowest barometer, 29.50 (749.3), at 8 a. m., in N. 48° 35', W. 32° 20'. Capt. G. Mitchell, of the s. s. "Trinacria," reports a strong westerly gale on the 12th; lowest barometer, 29.57 (751.1), at noon, in N. 41° 2', W. 33° 13'.

6.—This storm was a continuation of land depression number vii and passed north of east over Newfoundland during the early morning of the 13th, with central pressure about 29.40 (746.7); on the 14th the storm was central in N. 52°, W. 42°, with slight changes in pressure, whence it moved northeast to N. 55°, W. 26° by the 15th, after which it disappeared in the direction of the Scotch coast.

The following reports refer to this storm:

Capt. R. P. Moore, of the s. s. "Siberian," reports a westerly storm on the 13th and 14th; lowest barometer, 29.79 (756.7), at 4 p. m. of the 13th, in N. 49° 0', W. 41° 0'. The storm was attended by terrific squalls and very high seas, and blew strongest from sw. during the afternoon of the 13th, then veered to nw. and moderated, but increased during the 14th to strong and whole gale, wnw., and moderated at 8 p. m., in N. 47° 0', W. 45° 40'. Capt. W. Whiteway, of the s. s. "Palestine," reports a strong gale on the 14th and 15th; wind veered from ssw. to w.; lowest barometer, 29.50 (749.3), at midnight of the 14th, in N. 50° 30', W. 31° 0'. The gale began at 4 a. m. of the 14th from ssw., force 7; 8 a. m., ssw., force 8; noon, wsw., force 8; 1 p. m., veered to w., force 9, with high seas, heavy squalls, and hail, and continued the same through a. m. of the 15th, moderating at 4 p. m., in N. 50° 0', W. 33° 0'.

7.—This depression apparently developed off the coast of the United States during the early morning of the 15th, whence it circled northeast and disappeared over mid-ocean after the 18th. The storm was of moderate strength throughout, but displayed greatest energy on the 18th.

The following special reports refer to this storm:

The s. s. "Australia," on the 17th, had an unsteady se. and e. breeze in the afternoon, with much rain and threatening sky; by evening the wind had died out and lightning was observed all around the horizon; at 8 p. m., in N. 46° 48', W. 39° 50', the barometer read lowest, 29.00 (736.6), and a gale of hurricane force set in from the ne. and continued for six hours, with much rain, after which it decreased and was followed by strong northerly winds during the 18th. Capt. W. Jaues, of the s. s. "Warwick," reports a whole gale on the 18th and 19th; winds veered from se. to w.; lowest barometer, 29.47 (748.5), at 8 p. m. of the 18th, in N. 51° 8', W. 21° 5'. Second Officer F. Potts, of the s. s. "British Crown," Capt. A. Smith, commanding, reports a fresh sw. to nw. gale on the 18th and 19th; lowest barometer, 29.73 (755.1), at midnight of the 18th, in N. 50° 45', W. 14° 50'. The gale was accompanied by a very heavy cross sea. The barometer rose very rapidly during the 18th to 30.69 (779.5) at midnight.

8.—This depression first appeared over mid-ocean on the 16th, with pressure ranging below 29.00 (736.6); passing rapidly northeast, the storm was central on the 17th west of the northern extremity of Scotland, with a slight rise in central pressure, whence it passed beyond the region of observation. This depression was attended by severe disturbances, the nature of which will be seen by the following special reports:

Capt. W. Skjöldt, of the s. s. "Island," reports a hurricane from se., veering to nw., attaining greatest force on the 16th, on which date, at 11 p. m., the barometer read 28.55 (725.2), when in N. 48° 37', W. 20° 15'. Capt. G. Cochrane, of the s. s. "Helvetia," reports a whole gale on the 16th; wind veered from s. to nw.; lowest barometer, 29.15 (740.4), at 4 p. m., in N. 50° 17', W. 26° 30'. Capt. T. H. Schwaner, of the s. s. "Grasbrook," reports a whole gale from the 14th to the 16th; wind veered from sw. to ene.; lowest barometer, 29.26 (743.2), at 1.30 p. m. of the 16th, in N. 48° 5', W. 34° 48'. Second Officer S. Bakker, of the s. s. "Pennland," Capt. Rud Weyer, commanding, reports a s. to w. storm on the 15th and 16th; lowest barometer, 29.30 (744.2), at 1.30 a. m., in N. 47° 52', W. 37° 33'. The gale was accompanied by tremendous w. and sw. seas and very heavy rain. Capt. G. Franck, of the s. s. "Australia," reports a storm on the 15th and 16th; wind veered from nw. to sw.; lowest barometer, 29.18 (741.2), at 2 p. m. of the 16th, in N. 47° 50', W. 34° 45'. Capt. F. S. Land, of the s. s. "City of Berlin," reports a westerly gale, of force 9, on the 16th; lowest barometer, 29.09 (738.9), in N. 49° 22', W. 35° 0'.

Capt. J. Ueberweg, of the s. s. "Waesland," reports a strong westerly gale from the 14th to the 16th; lowest barometer, 29.30 (744.2), at 4 p. m. of the 16th, in N. 51° 25', W. 21° 57'. Capt. S. Walters, of the s. s. "Iowa," reports a fresh sw. to w. gale on the 16th and 17th; lowest barometer, 29.52 (749.8), at

4 a. m., in N. 50° 32', W. 13° 0'. Capt. John Jenkins, of the s. s. "Ripon City," reports: "16th, strong gale set in, with heavy rain, backing as it increased from s. to se.; 17th, in N. 58° 20', W. 6° 6'; 2 p. m., barometer 28.90 (734.0), wind increased to hurricane force until 3.30 p. m., when it veered to ssw. and continued strong gale, with heavy gusts, under the lee of the island of Lewis.

9.—This storm was a continuation of land depression number x, and, passing over the northern extremity of Newfoundland, moved rapidly northeast to N. 55°, W. 39° by the 22d, after which it circled southeast to N. 51°, W. 19°, by the 24th, whence it moved southeast and disappeared in the direction of the Spanish coast. This storm possessed moderate strength, and exhibited minimum pressure on the 24th.

The following reports refer to this storm:

The s. s. "British Crown" had a fresh gale on the 22d; wind veered from s. by e. to w.; lowest barometer, 29.55 (750.6), at 3 p. m., in N. 47° 40', W. 44° 30'. The gale was of short duration, commencing at 5 a. m. and ending at 6 p. m. The s. s. "Cephalonia" had a moderate gale on the 22d and 23d from s., veering to nnw; lowest barometer, 29.61 (752.1), from midnight of the 22d to 4 a. m. of the 23d, in N. 49° 0', W. 32° 0'. Capt. J. H. Taat, of the s. s. "Edam," reports a n. to w. storm on the 23d and 24th; lowest barometer, 29.02 (737.1), at 4 a. m. of the 23d, in N. 48° 45', W. 40° 23'. The s. s. "British Crown" encountered a strong gale, commencing at 1 a. m. of the 23d, from the w., force 7 to 9, with terrific squalls of wind, hail, and snow; noon, wind nw., force 8; midnight, in N. 48° 10', W. 42° 0', barometer 29.31 (744.5); 24th, barometer rising, with wind wnw., and violent squalls of wind and snow. The gale moderated in the p. m. of the 24th from the nw.

10.—This storm appeared over mid-ocean, in N. 51°, W. 34°, on the 24th and moved eastward to N. 52°, W. 22° by the 25th, after which it disappeared in the direction of the Irish coast. The disturbances accompanying this depression were probably the severest experienced on the north Atlantic during the month, and the depression was remarkable by reason of its apparent sudden development and dissipation.

The following special reports give the general character of the disturbances encountered:

The s. s. "Norwegian," on the 24th and 25th, had a storm, veering from s. to nne.; lowest barometer, 28.76 (730.5), at 8 p. m. of the 24th, in N. 52° 0', W. 28° 0'. Capt. P. J. Irving, of the s. s. "Republic," reports a whole gale on the 24th; wind veered from sse. to w.; lowest barometer, 28.89 (733.8), at 9 a. m., in N. 50° 9', W. 32° 56'. The wind shifted to w., with terrific squalls and tremendous seas. Capt. H. Supmer, of the s. s. "Donau," reports a whole westerly gale on the 23d and 24th; lowest barometer, 28.97 (735.8), at 3 p. m. of the 24th, in N. 47° 20', W. 39° 35'. Capt. F. Watkins, of the s. s. "City of Chicago," reports a strong ssw. to nw. gale on the 24th; lowest barometer, 29.14 (740.1), at 1 a. m., in N. 46° 0', W. 40° 30'.

Third Officer B. C. Lewis, of the s. s. "British Prince," Capt. S. Norvell, commanding, reports: "24th, in N. 48° 29', W. 31° 15', at noon, at 10.20 a. m., Greenwich mean time, the barometer stood at 29.38 (746.2). The pressure had been decreasing steadily since the 21st, and commenced to fall rapidly on the morning of the 24th, with wind sw., force 7; at noon, barometer 29.21 (741.9), wind shifted to wnw.; at 5.24 p. m. wind backed to wsw., force 7; the barometer reached its minimum, 29.00 (736.6), at 7.30 p. m., when the wind shifted suddenly to n. and freshened rapidly to force 10; the sea, which up to this time had been only high from the sw., shifted with the wind and became so heavy that the ship was brought head on. During the evening and night of the 24th the gale reached force 11, with violent squalls and very high sea." Capt. H. M. Frank, of the s. s. "Taormina," reports: "24th, in N. 48° 25', W. 41° 6', at noon; from 3 a. m. to 9 a. m. had a hurricane from sw. to nnw.; lowest barometer, 28.40 (721.3), at 5 a. m. At 8 a. m. saw a water-spout in a ne. direction."

Capt. J. Oseinak, of the s. s. "Bavarian," reports a hurri-

cane on the 24th; lowest barometer, 28.90 (734.0), at 9.40 a. m., in N. 49° 27', W. 34° 12'. The storm began at 8 p. m. of the 23d, in N. 50° 0', W. 31° 0', from wsw., force 8, with violent rain and hail squalls (10 p. m., very bright northern lights); a. m. of the 24th, winds wsw., force 7, heavy rain squalls and high sea; 5 a. m., backed to sw.; 6 a. m., ssw., force 8, misty and lightning; 8 a. m., ssw., force 9; noon, wind veered to nw.; 3.30 p. m., veered to n., force 12, with terrific sea; 4.30 p. m., nne., force 12, fearful hurricane and terrific seas breaking completely over the ship; 7.30 p. m., backed to n., force 11, with hurricane squalls and hail until a. m. of the 25th, when the gale moderated from nw., in N. 47° 18', W. 35° 30'. Capt. J. W. Jones, of the s. s. "Chicago," reports a westerly hurricane on the 24th; lowest barometer, 28.79 (731.3), at 2 p. m., in N. 49° 5', W. 33° 7'. Capt. G. C. Boothby, of the s. s. "Belgravia," reports a strong gale on the 23d and 24th; lowest barometer, 29.16 (740.7), at 3 a. m. of the 24th, in N. 54° 0', W. 23° 0'. The wind backed from sw. to sse., and veered to w. and wnw. Capt. H. M. Frank, of the s. s. "Taormina," reports a nw. to n. hurricane on the 24th; lowest barometer, 28.45 (722.6), at 5 a. m., in N. 48° 25', W. 41° 6'.

Capt. John Jenkins, of the s. s. "Ripon City," reports: "24th, in N. 50° 38', W. 30° 3', at noon, strong increasing gale from se., with rain and heavy sea from sw. and nw.; 5.30 p. m., barometer fell to 28.69 (728.7), wind shifted to wnw., with increasing sea; 7 p. m., heavy lightning in the northwest quarter; 9.30 p. m., wind shifted in a heavy squall to nnw., with hurricane force, accompanied with hail and sleet; on account of heavy cross-sea was obliged to run se. before the storm, which increased until 11 p. m., and backed to nw., with terrific squalls and sea; much oil was used with apparent good effect; sustained damage to boats, etc.; at 12 midnight the barometer was rising and the squalls subsiding; wind continued strong gale until noon of the 25th. The storm was the severest I ever experienced." Captain Luckhurst, of the s. s. "Wetherby," reports a hurricane from 5 a. m. of the 23d to 6 a. m. of the 24th; wind veered from sw. to nne.; force was greatest from n. to nne. from 8 p. m. to midnight of the 23d, in N. 49° 50', W. 33° 0'. The gale was accompanied by squalls of the most terrific description, and mountainous seas and rain at times.

Capt. Sam Brooks, of the s. s. "Arizona," reports: "25th, in N. 50° 46', W. 26° 28' (at noon), in a northerly gale the ship was boarded by a tremendous sea, which killed two seamen and injured eight, and smashed three boats. The entire westward passage, from the 24th to February 1st, was exceptionally stormy." Third Officer W. H. Logan, of the s. s. "Istrian," Capt. T. H. Fox, commanding, reports a fresh nw. to s. gale from the 23d to 25th; lowest barometer, 28.90 (734.0), at 4 a. m. of the 25th, in N. 50° 0', W. 22° 0'. The s. s. "Belgravia" had fresh to strong gales from the 24th to 31st; lowest barometer, 28.75 (730.2), at 1 p. m. of the 25th, in N. 52° 42', W. 28° 38'; wind backed from sw. to s. and veered to n., with force, save at short intervals, above 9 from the 24th to the 31st, and tremendous sea from sw. and w.

Capt. M. de Jousselein, of s. s. "La Bretagne," reports a storm on the 24th and 25th; wind veered from sse. to nnw.; lowest barometer, 28.81 (731.8), at 4 a. m. of the 25th, in N. 49° 27', W. 28° 45'. Third Officer J. H. Mills, of the s. s. "Aurania," Capt. W. H. P. Hains, commanding, reports: "Whole gale from sw., veering to n., on the 25th; lowest barometer at 10 a. m., in N. 49° 47', W. 28° 33'. Capt. Johannes Schade, of the s. s. "Polaria," reports a whole gale on the 24th and 25th; wind commenced ssw., force 8, at 10 a. m. of the 24th; backed to s. at 9 p. m., and attained its greatest force, 10 to 11, from 11 p. m. of the 24th to 4 a. m. of the 25th; afterwards veering to w. and nw.; lowest barometer, 29.27 (743.4), at 4 p. m. of the 25th, in N. 50° 5', W. 17° 58'.

11.—This storm was a continuation of land depression number xi, and, passing northeast over Newfoundland, was central on the morning of the 25th in N. 50°, W. 53°, with pressure ranging below 29.40 (746.7); by the 26th the depression had

moved north of east to N. 52°, W. 33°, with slight changes in central pressure, after which date it disappeared to the north-eastward beyond the region of observation.

The following special reports have been made in connection with this storm:

Capt. P. J. Irving, of the s. s. "Republic," reports a strong gale on the 25th; wind veered from sse. to w.; lowest barometer, 29.13 (739.9), at 9.40 p. m., in N. 47° 46', W. 37° 16'. The weather continued boisterous until the 29th, with wind ranging between s. and nne., with heavy sea and terrific squalls, the ship being continually flooded fore and aft; intensely cold just westward of the Banks. Capt. M. Garson, of the s. s. "Madrid," reports: "25th, in N. 37° 40', W. 54° 22', at noon, had s. to w. storm, attaining force 11. Before the gale commenced the upper clouds, cirro-cumulus, were moving from wnw., true, and the lower clouds from s.; just before the shift the wind blew in gusts of force 10 to 11, with very heavy rain. When the rain ceased the wind veered to w., force 7, and rapidly moderated to force 5; lowest barometer, 29.85 (758.2), at about 10 a. m.

The s. s. "British Crown" had a strong sw. to w. gale on the 25th and 26th; lowest barometer, 29.00 (736.6), at 3 p. m. of the 25th, in N. 46° 8', W. 49° 30'. The gale was accompanied by terrific squalls and very high seas, with shifts of wind to the northwestward. Capt. P. Urquhart, of the s. s. "Lord Clive," reports a whole sw. to w. gale on the 25th; lowest barometer, 29.20 (741.7), at 1 a. m., in N. 41° 36', W. 64° 45'. During the gale the sea was very high from the sw. and wsw., and continued strong after the gale was over. Capt. W. Stewart, of the s. s. "Lake Superior," reports a hurricane from the 25th to the 27th; wind veered from s. to nw.; lowest barometer, 29.34 (745.2), at 8 a. m. of the 26th, in N. 50° 38', W. 34° 0'. The s. s. "La Bretagne" encountered a whole s. to wnw. gale on the 26th; lowest barometer, 29.28 (743.7), at 3 a. m., in N. 47° 45', W. 36° 0'.

12.—This storm was a continuation of land depression number xii and was central off the south coast of Newfoundland on the morning of the 27th, with central pressure about 29.60 (751.8), whence it passed northeast to N. 52°, W. 37° by the 28th, with pressure about three-tenths lower than on the preceding day; from this position the storm-centre advanced to N. 54°, W. 24° on the 29th, with an appreciable loss of energy, after which it passed northeast beyond the region of observation.

The following are the reports of shipmasters relative to storms encountered during the passage of this depression:

The s. s. "British Crown" experienced a fresh gale on the 27th; wind backed from ne. to nnw., lowest barometer, 29.57 (725.7), at 6 a. m., in N. 45° 22', W. 57° 5'. Capt. M. Parry, of the s. s. "Prydian," reports a fresh gale from sse, veering to w., n., and nne. on the 27th; lowest barometer at 3.30 p. m. of the 27th, in N. 35° 10' W. 58° 57'. Capt. J. W. Janes, of the s. s. "Chicago," reports a westerly hurricane from the 26th to 28th; lowest barometer, 29.57 (751.1), at 4 a. m. of the 28th, in 46° 35', W. 39° 15'. The s. s. "Bavarian" encountered a south to west hurricane, which attained greatest force on the 28th, in N. 46° 42', W. 41° 28°, when barometer read 29.76 (755.9) at 9 a. m. Capt. C. Heibich, of the s. s. "Wieland," reports a whole westerly gale from the 27th to 29th; lowest barometer, 29.70 (754.4), at 4 a. m. of the 29th, in N. 49° 42', W. 24° 16'.

OCEAN ICE.

The only ice reported during the month was a medium sized berg observed from the s. s. "Wetherby" on the 30th, at 6.15 p. m., in N. 48° 30', W. 46° 0'.

In January, 1886, several icebergs were reported off the southeast coast of Newfoundland.

In January, 1885, icebergs were reported between W. 45° 30' and W. 42° 24', none being observed south of the forty-seventh parallel. In this month they were observed eleven days earlier and were about four degrees further eastward than those of January, 1884.

In January, 1883, the first icebergs reported were observed in N. 47° 35', W. 45° 04' on the 30th; in 1882 the first icebergs were seen in N. 47° 30', W. 48° 35' on the 30th.

From the above, it will be seen that the ocean ice observed during January, 1887, was somewhat less, in quantity, than the average for corresponding months of the five preceding years. The iceberg reported was, however, in the same locality as those first observed in the preceding years, and serves to indicate a seasonable southern movement of icebergs and field-ice from the Labrador coast.

FOG.

The following shows the limits of fog-areas encountered on the north Atlantic Ocean during January, 1887, as reported by shipmasters:

1st.—The s. s. "British Queen," in N. 44° 0', W. 64° 0', had fog from 3.26 p. m. until midnight, with southerly winds and pressure below the normal. The s. s. "Palmyra," in N. 42° 50', W. 62° 20', had dense fog from 11 a. m. to 1.30 p. m., and again at midnight and until noon of the 2d, in N. 42° 33', W. 67° 55', with southeast veering to southwest winds and falling barometer. The s. s. "Prussian," in N. 44° 14', W. 53° 52', had fog, at intervals, from 1 p. m. until 2 a. m. of the 2d, in N. 43° 0', W. 58° 0', with moderate southwest winds and falling barometer.

7th.—The s. s. "Paxo," in N. 46° 18', W. 48° 8', had dense fog from 8 a. m. to noon, with fresh so. breeze and pressure below the normal.

15th.—The s. s. "Siberian," in N. 46° 0', W. 48° 10', had dense fog from 4 to 11 p. m., with southerly winds and falling barometer.

23d.—The s. s. "Borderer," in N. 44° 10', W. 63° 10', had dense fog from 7 a. m. to 3.30 p. m., with moderate wsw. breeze and pressure about normal.

As in the two preceding months, fog was encountered with southerly winds and barometric pressure below the normal, or to the eastward of areas of low pressure.

TEMPERATURE OF THE AIR.

[Expressed in degrees, Fahrenheit.]

The distribution of mean temperature over the United States and Canada for January, 1887, is exhibited on chart ii by the dotted isothermal lines; and in the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service. On chart iv the departures from the normal are illustrated by lines connecting stations of normal or equal abnormal values.

During January, 1887, the temperature of the air has been above the normal on the Pacific slope and in the plateau regions and eastern slope of the Rocky mountains, except in eastern Montana. It has been normal or slightly above along the Atlantic coast from Eastport, Maine, to Hatteras, North Carolina. The departures in excess of the normal are small, except in the Rocky Mountain regions where they range from 4° 5 at Prescott, Arizona, to 8° 6 at Spokane Falls, Washington Territory. In Dakota, Minnesota, eastern Montana, the Missouri Valley, upper Mississippi valley, the Lake region, Saint Lawrence Valley, New England, the Ohio Valley, and the Southern States the temperature of the month has been below the normal. The deficiencies are especially large in Dakota, Minnesota, and the upper lake region, where the mean temperature of the month is about 7° 0 below the normal. In the south Atlantic and east Gulf states it is 2° 5 below the normal.

The following are some of the most marked departures from the normal temperature at Signal Service stations:

Above normal.		Below normal.	
Spokane Falls, Washington Territory...	8.6	Saint Paul, Minnesota.....	11.4
Las Animas, Colorado.....	8.1	Bismarck, Dakota.....	11.1
Boise City, Idaho.....	7.8	Fort Buford, Dakota.....	8.3
Fort Thomas, Arizona.....	7.4	Duluth, Minnesota.....	8.3
Helena, Montana.....	5.4	Marquette, Michigan.....	8.3
Winnemucca, Nevada.....	5.0	Omaha, Nebraska.....	7.8
Salt Lake City, Utah.....	4.6	Davenport, Iowa.....	7.7
Prescott, Arizona.....	4.5	Dubuque, Iowa.....	7.5

DEVIATIONS FROM NORMAL TEMPERATURES.

In the table below are given, for certain stations, as reported by voluntary observers, the normal temperatures of January for a series of years, the mean temperature for January, 1887, and the departures from the normal:

Station.	County.	Normal temperature for January.	Number of years.	Mean temperature for Jan., 1887.	Departure.
<i>Arkansas.</i>		0		0	0
Lead Hill.....	Boone.....	39.3	5	34.3	+ 5.0
<i>California.</i>					
Sacramento.....	Sacramento.....	46.5	21	44.3	- 2.2
<i>Connecticut.</i>					
Middletown *.....	Middlesex.....	24.8	29	22.7	- 2.1
New Haven *.....	New Haven.....	26.6	101	25.2	- 1.4
Thompson *.....	Windham.....	21.4	30	21.8	+ 0.4
<i>Dakota.</i>					
Webster.....	Day.....	1.3	4	- 12.6	-13.9
<i>Illinois.</i>					
Collinsville.....	Madison.....	25.1	8	23.9	- 1.2
Mattoon.....	Coles.....	24.8	7	24.0	- 0.8
Peoria.....	Peoria.....	24.1	31	21.0	- 3.1
Riley.....	McHenry.....	17.5	23	11.1	- 6.4
Sycamore.....	De Kalb.....	14.3	0	12.5	- 1.8
<i>Indiana.</i>					
Lafayette.....	Tippecanoe.....	22.8	8	20.1	- 2.7
Logansport.....	Cass.....	25.2	33	22.4	- 2.8
Vevay.....	Switzerland.....	31.4	21	30.3	- 1.1
<i>Iowa.</i>					
Cresco.....	Howard.....	10.1	15	3.0	- 7.1
Monticello.....	Jones.....	14.8	37	8.9	- 5.9
Muscatine.....	Muscatine.....	18.7	49	12.5	- 6.2
<i>Kansas.</i>					
Independence.....	Montgomery.....	27.8	16	27.1	- 0.7
Wellington.....	Sumner.....	24.2	9	26.7	+ 2.5
<i>Maine.</i>					
Belfast *.....	Waldo.....	19.0	28	17.5	- 1.5
Gardiner *.....	Kennebec.....	17.8	51	15.8	- 2.0
Orono *.....	Penobscot.....	15.4	19	14.0	- 1.4
<i>Maryland.</i>					
Cumberland.....	Alleghany.....	30.8	15	28.6	- 2.2
Fallston.....	Harford.....	29.7	10	28.6	- 1.1
<i>Massachusetts.</i>					
Amherst *.....	Hampshire.....	22.3	50	19.4	- 2.9
Cambridge *.....	Middlesex.....	24.9	65	22.8	- 2.1
Fitchburg *.....	Worcester.....	22.3	30	20.4	- 1.9
New Bedford *.....	Bristol.....	28.3	75	26.7	- 1.6
Somerset.....	Bristol.....	26.2	17	26.5	+ 0.3
Springfield *.....	Hampden.....	24.4	30	22.2	- 2.2
Taunton *.....	Bristol.....	26.1	16	26.1	0.0
Williamstown *.....	Berkshire.....	21.5	33	20.0	- 1.5
<i>Michigan.</i>					
Thornville.....	Lapeer.....	23.2	12	19.2	- 4.0
<i>Nevada.</i>					
Carson City.....	Ormsby.....	32.7	8	36.5	+ 3.8
<i>New Brunswick.</i>					
Saint John *.....	Saint John.....	18.0	27	17.6	- 0.4
<i>New Hampshire.</i>					
Concord *.....	Merrimack.....	21.5	19	19.2	- 2.3
Hanover *.....	Grafton.....	16.1	24	13.0	- 3.1
<i>New Jersey.</i>					
South Orange.....	Essex.....	28.2	17	28.7	+ 0.5
<i>New York.</i>					
North Volney.....	Oswego.....	21.9	19	19.0	- 2.9
Palermo.....	Oswego.....	20.3	34	17.0	- 3.3
<i>Ohio.</i>					
Wauseon.....	Fulton.....	22.7	17	19.3	- 3.4
<i>Pennsylvania.</i>					
Dyberry.....	Wayne.....	20.9	23	19.8	- 1.1
Grampian Hills.....	Clearfield.....	21.5	17	21.1	- 0.4
<i>South Carolina.</i>					
Stateburg.....	Sumter.....	43.8	6	42.4	- 1.4
<i>Texas.</i>					
New Ulm.....	Austin.....	50.3	14	49.6	- 0.7
<i>Vermont.</i>					
Lunenburg *.....	Essex.....	15.1	39	13.3	- 1.8
Newport *.....	Orleans.....	14.4	13	11.3	- 3.1
Strafford *.....	Orange.....	15.8	12	13.3	- 2.5
<i>Virginia.</i>					
Dale Enterprise.....	Rockingham.....	28.7	7	33.6	+ 4.9
Variety Mills.....	Nelson.....	34.1	10	32.9	- 1.2
<i>West Virginia.</i>					
Helvetia.....	Randolph.....	32.3	11	31.0	- 1.3
Parkersburg.....	Wood.....	35.5	8	31.0	- 4.5

* From the "Bulletin of the New England Meteorological Society."

The following notes on temperature are furnished by voluntary observers:

Dakota.—Webster, Day county: during the month the temperature has been below zero every day except the 15th; the daily mean has been below zero on twenty-four days.

Illinois.—Mattoon, Coles county: the highest temperature that has occurred in any January during the past seven years was 65° 0, in 1880; the lowest, -28° 0, in 1884; the highest mean temperature, 40° 0, occurred in 1880; the lowest mean, 19° 0, in 1881.

Riley, McHenry county: during the past twenty-three years the highest January mean temperature, 33° 4, occurred in 1875; the lowest mean, 5° 9, in 1880.

Indiana.—Vevay, Switzerland county: during the past twenty-one years the highest January temperature, 69° 0, occurred in 1866 and 1876; the lowest, -23° 0, in 1884.

Iowa.—Monticello, Jones county: the highest temperature that has occurred in any January during the past thirty-three years was 62° 0, in 1855; the lowest, —33° 0, in 1884; the highest mean temperature, 32° 9, occurred in 1880; the lowest mean, 3° 6, in 1875.

Kansas.—Wellington, Sumner county: the highest January mean temperature in the past nine years, 40° 4, occurred in 1880; the lowest, 17° 6, in 1886; the minimum temperature of the present month, —20° 0 on the 3d at 1 a. m., is lower than any previous reading in a record of the past nine years.

Maryland.—Cumberland, Alleghany county: table of temperature for January during the past fifteen years:

January.	Temperature.			January.	Temperature.		
	Highest.	Lowest.	Mean.		Highest.	Lowest.	Mean.
1873.....	46	0	30	1882.....	50	8	33
1874.....	67	6	36	1883.....	41	4	37
1875.....	45	—4	29	1884.....	54	—3	37
1876.....	65	15	38	1885.....	60	4	39
1877.....	55	3	30	1886.....	56	—6	25
1878.....	48	—5	29	1887.....	60	—6	29
1879.....	51	—5	27	Average.....	53.9	1.4	30.9
1880.....	64	12	39				
1881.....	46	—8	25				

New York.—Palermo, Oswego county: the highest January mean temperature during the past thirty-four years, 29° 4, occurred in 1880; the lowest, 12° 8, in 1881.

North Volney, Oswego county: during the past nineteen years the coldest January occurred in 1881, mean temperature, 15° 1; the warmest in 1880, mean, 31° 8.

Ohio.—Wauseon, Fulton county: the highest January mean temperature in the past seventeen years, 37° 7, occurred in 1880; the lowest mean, 12° 2, in 1875; the January extremes in that time are 69° 5, in 1876, and —31° 7, in 1884.

Pennsylvania.—Grampian Hills, Clearfield county: the highest January mean temperature in the past seventeen years, 33° 5, occurred in 1876; the lowest, 16° 1, in 1867.

South Carolina.—Stateburg, Sumter county: the mean temperature of the seven days from January 2d to 8th, inclusive, is 27° 7; the highest temperature during January in the past six years, 73° 0, occurred on the 16th in 1882; the lowest, 6° 0, on the 12th in 1886.

Texas.—New Ulm, Austin county: during the past fourteen years the highest January mean temperature, 63° 7, occurred in 1880; the lowest mean, 43° 2, in 1881; the January extremes for that time are 84° 0, in 1880, and 7° 0, in 1886.

Vermont.—Strafford, Orange county: the highest mean temperature for January during the past twelve years, 24° 7, occurred in 1880; the lowest mean, 11° 0, in 1883.

Virginia.—Variety Mills, Nelson county: the highest mean temperature for January during the past ten years, 44° 9, occurred in 1880; the lowest mean, 28° 7, in 1886.

Dale Enterprise, Rockingham county: during the past seven years the warmest January occurred in 1880, mean temperature, 34° 7; the coldest in 1881, mean, 20° 7.

In the following table are given the mean temperatures for the several geographical districts, with the normals and departures, as deduced from Signal Service observations:

Average temperatures for January.

Districts.	Average for January, Signal-Service observations.		Comparison of Jan., 1887, with the average for several years.
	For several years.	For 1887.	
New England.....	29.6	28.5	—1.1
Middle Atlantic States.....	33.3	33.0	—0.3
South Atlantic States.....	46.9	43.9	—3.0
Florida Peninsula.....	59.8	55.6	—4.2
Eastern Gulf States.....	47.8	45.5	—2.3
Western Gulf States.....	45.1	49.1	+4.0
Rio Grande Valley.....	36.6	58.6	+22.0
Tennessee.....	38.8	38.4	—0.4
Ohio Valley.....	31.2	29.4	—1.8
Lower Lake region.....	25.2	22.9	—2.3
Upper Lake region.....	18.0	12.8	—5.2
Extreme Northwest.....	0.4	—7.7	—8.1
Upper Mississippi Valley.....	22.2	17.1	—5.1
Missouri Valley.....	16.3	10.0	—6.3
Northern slope.....	13.5	14.9	+1.4
Middle slope.....	25.4	30.0	+4.6
Southern slope.....	39.0	41.8	+2.8
Southern plateau.....	40.4	43.5	+3.1
Middle plateau.....	29.2	34.0	+4.8
Northern plateau.....	25.7	33.9	+8.2
North Pacific coast region.....	39.2	42.3	+3.1
Middle Pacific coast region.....	45.7	49.7	+4.0
South Pacific coast region.....	53.5	55.1	+1.6

RANGES OF TEMPERATURE.

The monthly, and the greatest and least daily, ranges of temperature, are given in the table of miscellaneous meteorological data.

The following are some of the greatest and least monthly ranges at Signal Service stations:

Greatest.	Least.
Las Animas, Colorado..... 93.8	Tatoosh Island, Washington Ter..... 20.1
Dodge City, Kansas..... 89.9	Fort Canby, Washington Ter..... 21.3
Bismarck, Dakota..... 88.1	Astoria, Oregon..... 22.0
Fort Buford, Dakota..... 87.7	Port Angeles, Washington Territory..... 22.7
Fort Supply, Indian Territory..... 87.3	Pysht, Washington Territory..... 23.0
Denver, Colorado..... 84.5	Olympia, Washington Territory..... 28.5
Fort Yates, Dakota..... 81.6	Key West, Florida..... 28.6

Table of comparative maximum and minimum temperatures for January.

State or Territory.	Station.	For 1887.		Since establishment of station.		
		Max.	Min.	Max.	Year.	Min. Year.
Alabama.....	Mobile.....	72.0	15.9	78.0	1882	11.0 1886
Do.....	Montgomery.....	74.0	12.9	78.5	1882	5.4 1886
Arizona.....	Prescott.....	62.8	11.2	71.0	1882	—17.0 1880
Do.....	Fort Apache.....	65.0	10.5	67.0	1881, 1882	9.5 1886
Arkansas.....	Fort Smith.....	72.7	4.0	73.5	1882	—12.0 1881
Do.....	Little Rock.....	72.2	7.0	78.0	1880	4.8 1886
California.....	San Francisco.....	72.9	41.5	69.0	1877	36.0 1876, 1883
Do.....	San Diego.....	74.0	38.0	78.0	1877	33.0 1880
Colorado.....	Denver.....	60.9	—17.6	67.0	1882	—29.0 1875
Do.....	Pike's Peak.....	19.0	—20.7	30.0	1879	—37.0 1883
Connecticut.....	New Haven.....	51.1	—5.4	63.0	1876	—14.0 1873
Do.....	New London.....	56.4	0.1	65.0	1880	—14.0 1873
Dakota.....	Fort Buford.....	42.5	—45.2	47.0	1880	—48.2 1886
Do.....	Yankton.....	47.4	—29.1	67.0	1880	—33.0 1881
District of Columbia.....	Washington City.....	67.2	6.2	71.0	1874, 1876	—14.0 1881
Florida.....	Jacksonville.....	76.3	21.9	80.0	1875, 1876, 1877, 1879	15.3 1886
Do.....	Key West.....	78.8	50.2	90.0	1877	40.8 1886
Georgia.....	Atlanta.....	68.8	9.0	73.0	1879, 1882	3.4 1886
Do.....	Savannah.....	70.7	16.0	80.0	1879	12.0 1886
Idaho.....	Boise City.....	55.2	15.7	61.5	1884	7.3 1885
Illinois.....	Cairo.....	66.1	—1.1	70.0	1876, 1880	—16.0 1884
Do.....	Chicago.....	52.0	—15.3	61.0	1880	—20.0 1875
Indiana.....	Indianapolis.....	64.4	—11.8	69.0	1876	—25.0 1884
Indian Territory.....	Fort Sill.....	75.9	0.2	75.0	1880	9.0 1879
Iowa.....	Dubuque.....	41.5	—31.5	62.0	1874	—26.2 1883
Do.....	Des Moines.....	41.8	—24.5	63.0	1880	—30.4 1884
Kansas.....	Dodge City.....	72.9	—17.0	70.0	1876	—20.0 1883
Do.....	Leavenworth.....	60.2	—15.5	65.0	1876	—29.0 1873
Kentucky.....	Louisville.....	67.2	—4.7	71.0	1876	—19.5 1884
Louisiana.....	New Orleans.....	78.0	31.4	78.0	1879	15.3 1886
Do.....	Shreveport.....	76.1	12.0	78.0	1876, 1880	1.3 1886
Maine.....	Eastport.....	50.3	—13.4	51.0	1874	—20.0 1874
Do.....	Portland.....	47.2	—14.7	58.0	1876	—12.4 1886
Maryland.....	Baltimore.....	65.3	7.3	71.0	1876	6.0 1881
Massachusetts.....	Boston.....	55.9	—5.0	69.5	1876	—13.0 1882
Michigan.....	Marquette.....	37.2	—20.6	56.0	1880	—26.0 1881
Do.....	Grand Haven.....	48.1	—2.1	57.0	1880	—12.0 1873
Minnesota.....	Saint Vincent.....	22.8	—42.2	39.0	1885	—46.0 1885
Do.....	Saint Paul.....	31.5	—35.7	49.0	1879	—35.6 1884
Mississippi.....	Vicksburg.....	76.2	9.6	80.0	1879	3.1 1886
Missouri.....	Saint Louis.....	65.6	—9.6	72.0	1880	—21.5 1884
Montana.....	Fort Assinaboine.....	43.2	—35.0	46.1	1885, 1886	—49.3 1886
Do.....	Helena.....	47.9	—25.3	57.0	1885	—34.0 1883
Nebraska.....	North Platte.....	56.0	—21.4	70.0	1880	—27.0 1881
Do.....	Omaha.....	51.1	—21.9	62.0	1879, 1880	—33.0 1884
Nevada.....	Winnemucca.....	57.2	7.5	57.0	1878, 1886	—14.0 1879
New Hampshire.....	Mount Washington.....	36.8	—35.4	42.0	1874	—50.0 1885
New Jersey.....	Atlantic City.....	49.4	7.0	64.0	1880	3.0 1875
New Mexico.....	Santa Fe.....	55.5	6.0	76.0	1879	—13.0 1883
New York.....	Buffalo.....	56.0	—1.7	65.5	1874	—13.5 1884
Do.....	New York City.....	62.6	6.0	64.0	1876, 1880	6.0 1875
North Carolina.....	Charlotte.....	68.9	8.2	70.0	1879, 1880	0.6 1886
Do.....	Wilmington.....	73.0	14.6	77.0	1879	9.0 1884
Ohio.....	Cincinnati.....	65.5	—5.3	69.0	1876	—12.4 1886
Do.....	Sandusky.....	64.4	—8.0	64.0	1880	—16.5 1879
Oregon.....	Portland.....	58.1	29.3	60.0	1886	3.0 1875
Do.....	Roseburg.....	58.1	23.3	66.0	1885	12.0 1883
Pennsylvania.....	Pittsburg.....	67.8	4.0	75.0	1874	—12.0 1873
Do.....	Philadelphia.....	65.6	8.1	67.0	1876	—5.0 1875
Rhode Island.....	Block Island.....	56.1	1.8	58.8	1885	4.0 1882
South Carolina.....	Charleston.....	69.6	16.7	80.0	1879	10.5 1886
Tennessee.....	Knoxville.....	68.8	5.4	74.0	1876	—16.0 1884
Do.....	Memphis.....	72.2	4.3	73.0	1876, 1880	8.0 1886
Texas.....	Brownsville.....	87.6	27.8	82.0	1880	18.0 1881
Do.....	Fort Elliott.....	73.4	—4.4	81.0	1880	—12.0 1883
Utah.....	Salt Lake City.....	51.5	11.9	54.2	1879	—20.0 1883
Virginia.....	Lynchburg.....	65.4	6.1	72.0	1876, 1879	4.0 1877
Do.....	Norfolk.....	69.0	12.6	80.0	1871	8.0 1879
Washington Ter.....	Spokane Falls.....	51.2	9.3	50.9	1884	—14.0 1885
Do.....	Olympia.....	54.5	26.0	59.0	1885	9.0 1883
Wisconsin.....	La Crosse.....	41.0	—28.9	59.0	1874	—43.0 1873
Do.....	Milwaukee.....	42.3	—15.9	59.0	1871, 1874	—25.0 1875
Wyoming.....	Cheyenne.....	63.0	—15.9	63.0	1880	—35.0 1875

FROSTS.

Frosts occurred in the various districts on the following dates:
New England.—1st to 31st.

Middle Atlantic states.—1st to 31st.

South Atlantic states.—1st to 13th, 15th to 20th, 22d, 25th to 28th, 31st.

Florida Peninsula.—2d, 3d, 4th, 11th, 12th, 14th to 18th, 20th, 21st, 25th.

East Gulf states.—1st to 4th, 6th, 10th, 11th, 12th, 16th, 18th, 19th, 24th, 25th, 27th.

West Gulf states.—1st to 12th, 14th, 15th, 18th, 19th, 24th, 26th, 27th, 29th.

Rio Grande Valley.—Rio Grande City, Texas, 2d, 3d, 5th, 10th; Brownsville, 10th.

Tennessee.—1st to 12th, 14th, 15th, 17th, 18th, 19th, 23d, 24th, 26th, 27th, 29th, 30th, 31st.

Ohio Valley.—1st to 21st, 24th to 31st.

Lower lake region.—1st to 22d, 24th to 31st.

Upper lake region.—1st to 31st.

Extreme northwest.—1st to 31st.

Upper Mississippi valley.—1st to 31st.

Missouri Valley.—1st to 31st.

Northern slope.—1st to 31st.

Middle slope.—1st to 31st.

Southern slope.—1st to 12th, 15th to 29th.

Southern plateau.—1st to 31st.

Middle plateau.—1st to 31st.

Northern plateau.—1st to 31st.

North Pacific coast region.—1st to 11th, 15th, 16th, 17th, 19th, 20th, 23d to 28th, 30th, 31st.

Middle Pacific coast region.—1st, 3d, 4th, 5th, 7th to 11th, 16th, 17th, 22d to 31st.

South Pacific coast region.—7th, 9th to 12th, 15th, 21st, 23d to 30th.

ICE.

Ice formed on calm water in the southern districts of the country on the following dates:

Alabama.—Livingston, 3d.

Arizona.—Yuma, 10th, 11th, 12th; Maricopa, 12th.

California.—Sacramento, 9th, 10th, 11th, 17th, 26th, 28th, 29th; San Diego, 11th.

Florida.—Jacksonville, 2d, 3d, 4th, 19th; Sanford, 2d, 3d, 19th; Pensacola, 2d, 18th; Archer, 2d, 3d, 4th, 11th; Duke, 3d.

Georgia.—Quitman, 2d, 3d, 4th; Savannah, 11th, 19th.

Louisiana.—Shreveport, 1st, 2d, 5th, 9th, 10th, 12th.

North Carolina.—Smithville, 3d, 4th, 5th, 11th, 18th, 19th.

South Carolina.—Spartanburg, 1st to 4th, 10th, 18th; Stateburg, 2d to 12th, 18th, 19th, 20th, 27th; Charleston, 3d, 18th, 19th.

Texas.—San Antonio, 1st, 2d, 3d; Corsicana, 1st to 8th, 10th, 11th, 12th, 17th, 18th, 19th, 23d, 24th, 26th, 30th; Palestine, 5th; Rio Grande City, 10th.

PRECIPITATION.

[Expressed in inches and hundredths.]

The distribution of rainfall over the United States and Canada for January, 1887, as determined from the reports of about six hundred stations, is exhibited on chart iii, and in the table of miscellaneous data are given, for Signal Service stations, the total precipitation, with the departures from the normal. With the exception of the eastern half of Georgia and the southern half of South Carolina, the precipitation of the month is below the normal in all parts of the country lying south of the fortieth parallel; it is also deficient in northern Idaho, northern Montana, Nebraska, Iowa, and northern Michigan. The departures are quite large in the south Atlantic and Gulf states; in the latter district the deficiency averages over two inches; the deficiency is also large in the Ohio Valley and Tennessee, the departures averaging over one inch below the normal. The rainfall of the month in California is very small for the season; in the northern and central parts of the state it is only about one-fourth and in the southern part only one twenty-second of the normal; reports from various parts of the state indicate that the lack of rain is already beginning to injure the grain and other crops. In New England, Canada, the Lake region, Minnesota, Dakota, and in the northern

Pacific coast region the precipitation of the month is in excess of the normal; the departures are especially large along the coast of Washington Territory and Oregon, also in eastern Maine and the Canadian Maritime Provinces.

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows, for certain stations, as reported by voluntary observers, the average precipitation for the month of January for a series of years, the precipitation for January 1887, and the departures from the average:

Station.	County.	Average precipitation for Jan.	Number of years.	Precipitation for Jan., 1887.	Departure.
<i>Arkansas.</i>					
Lead Hill	Boone	2.60	5	1.33	-1.27
<i>California.</i>					
Sacramento	Sacramento	4.18	21	1.07	-3.11
<i>Connecticut.</i>					
Canton	Hartford	3.60	25	5.87	+2.27
Hartford	Hartford	3.96	15	5.92	+1.96
Middletown	Middlesex	4.16	29	7.07	+2.91
New Haven	New Haven	4.18	15	4.24	+0.06
Wallington	New Haven	4.38	29	5.71	+1.33
<i>Dakota.</i>					
Webster	Day	1.58	4	4.55	+2.97
<i>Illinois.</i>					
Collinsville	Madison	1.79	5	0.60	-1.19
Mattoon	Coles	2.66	7	1.30	-1.36
Peoria	Peoria	1.62	31	1.10	-0.52
Biley	McHenry	1.82	25	3.59	+1.77
Sycamore	De Kalb	2.48	6	3.93	+1.45
<i>Indiana.</i>					
Lafayette	Tippecanoe	2.91	8	1.18	-1.73
Logansport	Cass	1.71	33	2.85	+1.14
Vevay	Switzerland	4.11	21	4.18	+0.07
<i>Iowa.</i>					
Cresco	Howard	1.30	15	0.73	-0.57
Monticello	Jones	1.05	34	2.39	+0.74
<i>Kansas.</i>					
Independence	Montgomery	1.40	15	0.79	-0.61
Wellington	Sumner	0.71	9	0.48	-0.23
<i>Louisiana.</i>					
Grand Coteau	Saint Landry	9.42	4	2.57	-6.85
<i>Maine.</i>					
Gardiner	Kennebec	3.47	49	7.32	+3.85
Orono	Penobscot	3.90	19	7.50	+3.60
<i>Maryland.</i>					
Cumberland	Alleghany	2.09	15	0.30	-1.79
Fallston	Harford	3.83	10	2.72	-1.11
<i>Massachusetts.</i>					
Amherst	Hampshire	3.31	52	4.83	+1.52
Cambridge	Middlesex	4.13	46	7.04	+2.91
Chestnut Hill	Middlesex	4.35	12	5.57	+1.22
Frammingham	Middlesex	4.16	13	5.20	+1.04
Lake Cochituate	Middlesex	3.80	30	5.39	+1.59
Lynn	Essex	3.98	13	0.20	-3.78
Mystic Lake	Middlesex	4.14	12	5.22	+1.08
New Bedford	Bristol	3.88	74	0.02	-3.86
Somerset	Bristol	4.30	17	6.08	+1.78
Springfield	Hampden	3.42	40	4.85	+1.43
Waltham	Middlesex	3.05	62	3.99	+0.94
Williamstown	Berkshire	2.66	22	5.29	+2.63
<i>Nevada.</i>					
Carson City	Ormsby	2.01	8	1.01	-1.00
<i>New Brunswick.</i>					
Saint John	Saint John	4.87	27	10.95	+6.08
<i>New Hampshire.</i>					
Concord	Merrimac	3.08	31	3.35	+0.27
Hanover	Grafton	2.63	21	4.82	+2.19
<i>New Jersey.</i>					
South Orange	Essex	3.96	17	3.50	-0.46
<i>New York.</i>					
Palermo	Oswego	3.31	34	5.39	+2.08
<i>Ohio.</i>					
Wauseon	Fulton	2.20	13	2.36	+0.16
<i>Pennsylvania.</i>					
Dyberry	Wayne	2.99	18	4.00	+1.01
Grampian Hills	Clearfield	3.56	17	2.57	-0.99
<i>South Carolina.</i>					
Kirkwood	Kershaw	3.32	20	3.13	-0.19
Stateburg	Sumter	3.98	6	3.30	-0.68
<i>Texas.</i>					
New Ulm	Austin	4.13	14	1.09	-3.04
<i>Vermont.</i>					
Lunenburg	Essex	3.01	39	3.00	-0.01
Newport	Orleans	3.34	12	5.88	+2.54
Stratford	Orange	3.20	12	5.50	+2.30
<i>Virginia.</i>					
Dale Enterprise	Rockingham	3.01	7	3.42	+0.39
Variety Mills	Nelson	4.14	5	2.16	-1.98
<i>West Virginia.</i>					
Helvetia	Randolph	5.47	11	3.75	-1.72

* From the "Bulletin of the New England Meteorological Society."

The following notes, in connection with this subject, are furnished by voluntary observers:

Kansas.—Wellington, Sumner county: the precipitation of the month was all in the form of snow, which fell to a depth of 5.5 inches. During the past nine years the largest monthly rainfall for January, 1.54, occurred in 1886; the lowest, 0.18, in 1881.

New York.—Palermo, Oswego county: the total snowfall of the month, 51 inches, is 27 inches above the January average of the last thirty-four years; it is also the greatest amount that has fallen in January during that time; the smallest, 2 inches, fell in 1882.

Ohio.—Wauseon, Fulton county: the total snowfall of the month, 15.3 inches, is 3.8 inches above the average of the past thirteen years; the largest January snowfall in that time, 22.2 inches, occurred in 1885; the least, 5.0 inches, in 1880.

Texas.—New Ulm, Austin county: during the past fourteen years the heaviest January precipitation, 10.56, fell in 1882; the least, 1.09, in 1887.

The following are some of the most marked departures from the normal precipitation at Signal Service stations:

Above normal.		Below normal.	
	Inches.		Inches.
Portland, Oregon.....	5.27	Red Bluff, California.....	4.90
Eastport, Maine.....	4.03	Mackinaw City, Michigan.....	4.11
Alpena, Michigan.....	2.68	Charlotte, North Carolina.....	3.91
Roseburg, Oregon.....	2.44	Palestine, Texas.....	3.86
Deadwood, Dakota.....	2.14	Atlanta, Georgia.....	3.83
Grand Haven, Michigan.....	2.00	Kitty Hawk, North Carolina.....	3.53
Dubuque, Iowa.....	1.74	Cedar Keys, Florida.....	3.42

In the following table are shown, for the several geographical districts, the normal precipitation for January, the average for January, 1887, and the excess or deficiency, as compared with the normal:

Average precipitation for January.

Districts.	Average for Jan. Signal-Service ob- servations.		Comparison of Jan., 1887, with the aver- age for several years.
	For sev- eral years.		
	Inches.	Inches.	
New England.....	4.76	5.90	+ 1.14
Middle Atlantic States.....	3.88	3.14	- 0.74
South Atlantic States.....	4.77	3.73	- 1.04
Florida Peninsula.....	3.24	1.94	- 1.30
Eastern Gulf States.....	6.12	4.09	- 2.03
Western Gulf States.....	4.15	2.01	- 2.14
Rio Grande Valley.....	1.67	0.12	- 1.55
Tennessee.....	6.26	4.93	- 1.33
Ohio Valley.....	3.55	2.39	- 1.16
Lower lake region.....	2.73	1.95	- 0.78
Upper lake region.....	2.22	2.54	+ 0.32
Extreme northwest.....	0.58	0.65	+ 0.07
Upper Mississippi Valley.....	1.90	1.44	- 0.46
Missouri Valley.....	0.66	0.63	- 0.03
Northern slope.....	1.03	1.42	+ 0.39
Middle slope.....	0.44	0.19	- 0.25
Southern slope.....	0.83	trace	- 0.83
Southern plateau.....	0.83	0.10	- 0.73
Middle plateau.....	1.24	1.44	+ 0.20
Northern plateau.....	2.75	2.30	- 0.45
North Pacific coast region.....	7.28	10.11	+ 2.83
Middle Pacific coast region.....	4.89	1.20	- 3.69
South Pacific coast region.....	1.74	0.08	- 1.66

SNOW.

Augusta, Georgia: sleet and rain fell during the early morning of the 5th; at 10.45 a. m. snow began falling and continued until 3.05 p. m., depth, 1.1 inches. Owing to the low temperature that prevailed on the 5th and 6th the snow did not melt until noon of the latter day. A light fall of snow occurred also on the 7th. At Columbia, South Carolina, sleet and snow fell for fifteen hours, the fall of snow being greater than any other that has occurred during the past six years. In the western portion of the state, and in western North Carolina, the fall was very heavy. This is the second heavy snowfall that has occurred in Georgia and South Carolina this winter.

Lansing, Michigan: light snow fell during the 13th until late in the afternoon, when it began falling heavily. Snow fell also on the 14th, from 8.10 a. m. to 7.30 p. m., total depth 13 inches; the storm was accompanied by north, backing to north-west, winds and low barometer. The fall of snow was very heavy over the surrounding country, delaying all trains several hours; street-car travel was entirely suspended on the 14th.

Huron, Dakota: the Chicago and Northwestern Railroad, in western Minnesota, was blockaded by snow from the 16th to 22d; on the latter date the first through mail since the 15th

arrived. Travel on the same road was impeded by snow on the 24th, 25th, 26th, and 29th.

Saint Vincent, Minnesota: on the 18th the barometer fell rapidly, with rising temperature and high southerly, veering to northerly, winds. At 10.30 a. m. a gale set in, attaining at 12.15 p. m. a velocity of forty-four miles per hour from the south. The high wind caused the snow which fell on the 16th to drift into railroad cuttings, delaying trains.

Salt Lake City, Utah: light snow began falling at 3.36 p. m. of the 24th and continued until midnight. Trains on all railroads passing through the city were delayed two to eight hours by heavy snow in the mountains.

Fort Buford, Dakota: snow fell during the night of the 28-29th and, being followed on the 29th by a heavy westerly gale, drifted badly. The gale began at 2.50 a. m. and continued until 11.50 p. m., attaining between 11 a. m. and noon a velocity of forty-seven miles per hour. Travel on the Northern Pacific Railroad was suspended, the road being badly blockaded by snow. During the storm the temperature was 21° 8 below zero.

Bismarck, Dakota: light snow fell during the night of the 28-29th. At 7.30 a. m. of the 29th a northwesterly gale, accompanied by rapidly falling temperature, began, attaining at 12.25 and 10.05 p. m. a velocity of thirty miles per hour. The snow that had fallen during the night drifted to such an extent as to render travel impossible, and trains on the Northern Pacific Railroad were blockaded for the first time this season.

Moorhead, Minnesota: on the 29th snow fell from 3 to 9 a. m.; at 6.30 a. m. a severe northwesterly gale set in and continued until 10.50 p. m.; maximum velocity of the gale thirty-six miles per hour, with a minimum temperature of 31° 3 below zero. During the storm the snow drifted badly and trains on all roads were delayed.

The dates on which snow fell in the various districts are, as follows:

New England.—1st to 31st.

Middle Atlantic states.—1st, 2d, 4th to 10th, 12th to 19th, 21st, 23d to 31st.

South Atlantic states.—1st, 3d, 5th to 9th, 17th, 18th.

East Gulf states.—Vicksburg, Mississippi, 2d, 4th, 5th; Greensborough, Montgomery, and Livingston, Alabama, and Pensacola, Florida, 5th; Atlanta, Georgia, 5th, 7th.

West Gulf states.—Little Rock, Arkansas, 2d, 4th; Fort Smith, Arkansas, 2d, 8th; Shreveport, Louisiana, 4th, 5th; Palestine, Texas, 4th, 8th, 9th.

Tennessee.—1st to 5th, 9th, 26th.

Ohio Valley.—1st to 19th, 24th, 25th, 26th, 29th, 30th, 31st.

Lower lake region.—1st to 21st, 23d to 26th, 28th to 31st.

Upper lake region.—1st to 31st.

Extreme northwest.—3d, 4th, 5th, 9th to 16th, 19th to 20th, 21st, 24th, 25th, 28th, 29th, 31st.

Upper Mississippi valley.—1st, 3d to 17th, 22d to 25th, 29th, 30th, 31st.

Missouri Valley.—1st to 9th, 11th to 16th, 21st to 26th, 28th to 31st.

Northern slope.—1st to 10th, 12th to 31st.

Middle slope.—1st, 2d, 4th to 8th, 10th, 12th, 13th, 14th, 16th, 19th to 22d, 25th, 27th, 28th, 31st.

Southern slope.—8th, 22d.

Southern plateau.—4th, 7th, 8th, 21st, 22d, 23d.

Middle plateau.—5th to 16th, 18th to 22d, 24th to 30th.

North Pacific coast region.—11th, 15th, 16th, 18th to 27th, 29th, 30th, 31st.

Middle Pacific coast region.—15th, 18th, 19th, 20th, 24th.

LARGEST MONTHLY SNOWFALLS.

[Expressed in inches and tenths.]

Monthly snowfalls of ten inches or more were reported from the various states and territories during the month, as follows:
California.—Summit, 56; Cisco, 40.5; Emigrant Gap, 21.5; Boca, 16.

Connecticut.—Hartford *a*, 33.5; Hartford *b*, 32.5; North Colebrook, 31.5; Collinsville, 28.2; Canton, 27; Middletown, 23; Bethel, 19; Norfolk, 18; Wallingford, 15.8.

Dakota.—Deadwood, 35.8; Fort Sully, 31; Richardtown, 19; Webster, 16; Fort Totten, 13; Fort Buford, 11.5.

Idaho.—Fort Cœur d'Alene, 17.1.

Illinois.—Lake Forest, 27.2; Waukegan, 24; Prairieville, 22.2; Sandwich, 22; Rockford, 20.5; Aurora, 19.4; Sycamore, 18; Chicago, 16.8; Woodstock, 15.9; Riley, 15.5; Ottawa, 15; Monmouth, 12.

Indiana.—Franklin, 12.7; Logansport, 11.7; Angola, 10.

Iowa.—Dubuque, 20.3; Des Moines *a*, 17.5; Des Moines *b*, 17.2; Bancroft, 12; Oskaloosa and Independence, 11.2; Monticello, 10.8.

Maine.—Gardiner, 35.7; Orono *a*, 35.5; Orono *b*, 33.5; Belfast, 32; Livingston, Cornish, and Kent's Hill, 26; Solon, 25.5; Portland, 24.8; Eastport, 22.5.

Massachusetts.—Fall River, 40; Gilbertville, 39; Monson, Rowe, and Nonotuck, 37; Fitchburg *a*, 35.5; Lawrence, 33.2; Deerfield, 33; Newburyport, 32.5; Holyoke, 30.7; Concord, 30.2; Dudley, 30; Springfield, 29.8; Amherst *a*, 29.5; Worcester, 29.2; Westborough, 28; Leominster, 27.5; Fitchburg *b*, 27; Williamstown *a*, 26; Amherst *b*, 25.5; Williamstown *b*, 24; Ludlow and Winchester, 23; Beverly Farms, 21; Blue Hill (base), 18; Cambridge, 17.9; Salem, 16.8; Blue Hill (summit), Boston, and South Hingham, 16; Milton, 15; Somerset, 14.8; Wood's Holl, 14.4; Randolph, 13; Taunton, 12.5; Plymouth, 11.

Michigan.—Alpena, 51.9; Traverse City, 41.5; Thornville, 25.5; Mackinaw City, 23.7; East Saginaw and Lansing, 21.8; Marquette, 20.2; Grand Haven, 19.5; Detroit, 18.9; Hudson and Swartz Creek, 17.5; Kalamazoo, 14.4; Port Huron, 14; Escanaba, 13.4; Mottville, 13; Birmingham, 10.5.

Minnesota.—Saint Paul, 22; Duluth, 20.5; Minneapolis, 13.7; Saint Cloud, 10.8.

Montana.—Fort Maginnis, 31.1; Helena, 16.2; Fort Assinaboine, 15.9.

Nebraska.—Tecumseh, 11; Valentine, 10.2.

Nevada.—Tonno, 23.

New Brunswick.—Parker's Ridge, 55; Saint John, 30.

New Hampshire.—Quincy, 41.4; Manchester *a*, 35.5; Berlin Mills, 34.5; Manchester *b* and Nashua, 32; Antrim, 30.9; Concord, 27; Walpole, 26.5; Shelburne and Grafton, 26; Hanover, 23.5; Mount Washington, 22.2; West Milan, 21.2; Strafford, 18.

New Jersey.—Roseland, 13; Dover, 12.8.

New York.—Palermo, 51.5; Lebanon Springs, 38; Oswego, 32.5; North Concord, 29.8; Auburn, 24; Cooperstown, 23.5; Albany, 20.5; Le Roy, 20.2; Buffalo, 19.2; Humphrey and Menand's, 18.5; Boyd's Corners, 18.2; North Volney, 17; Rochester, 12; White Plains, 11.

Ohio.—Wauseon, 15.3; Garrettsville and Toledo, 13.4; Hiram, 11.5; Tiffin, 11.2; Napoleon, 10.8; Columbus and Sandusky, 10.3; Cleveland, 10.

Oregon.—Linkville, 21.8; La Grande, 13; East Portland, 11.1.

Pennsylvania.—Erie, 23; Phillipsburg, 20.8; Grampian Hills, 14; Zionville and Catawissa, 10.6; Quakertown, 10.5; Blooming Grove, 10.

Rhode Island.—Providence *a*, 16.5; Lonsdale, 15; Pawtucket, 13.8; Providence *b* and Woonsocket, 12; Bristol and Olneyville, 10.5.

Utah.—Salt Lake City, 23.1; Ogden, 14.8; Promontory, 11.5.

Vermont.—Strafford, 46; Brattleborough, 44.8; Jacksonville, 43; Marlborough, 37.9; Vernon, 36; Chelsea, 31.4; Burlington and Lunenburg, 29; Newport, 28.8; Poultney, 25; Cornwall, 24.5; Post Mills *a*, 23; Post Mills *b*, 21; Charlotte, 17.

Washington Territory.—Pysht, 11.

Wisconsin.—Green Bay, 28.2; Milwaukee, 19.6; Manitowoc, 18.8; Embarras, 17.4; Wausau, 16.5; Delavan, 13.4; Madison, 13.1; Fond du Lac, 12; Franklin, 11.

Wyoming.—Fort Bridger, 12.5.

DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

[Expressed in inches and tenths.]

Connecticut.—North Colebrook, 9; Bethel, trace.

Dakota.—Richardton, 36; Deadwood, 30; Fort Buford, 24.3; Webster, 20; Bismarek, 9.8; Fort Totten, 6.8.

Illinois.—Riley, 10; Sycamore, 6; Chicago, 4.5; Windsor, trace.

Indiana.—Logansport, 2.8;

Iowa.—Dubuque, 15.9; Monticello, 14; Independence, 12; Bancroft, 10; Cresco and Humboldt, 6; Oskaloosa, 5; Cedar Rapids, 4; Davenport, 3; Des Moines, 1.8; Fort Madison, 0.5.

Kansas.—Leavenworth, 11.4; Dodge City, 0.8.

Maine.—Kent's Hill, 16; Gardiner, 10; Portland, 7; Eastport, 0.5.

Massachusetts.—Westborough, 8; Deerfield, 6; Amherst *a*, 1; Amherst *b*, trace.

Michigan.—Traverse City, 35; Marquette, 14; Mackinaw City, 12; Grand Haven, 8; Detroit, Escanaba, and Alpena, 6; Kalamazoo, 5.5; Lansing, 4; East Saginaw, Hudson, and Lansing, 3; Mottville, 2; Thornville, 1.5; Port Huron, 0.3.

Minnesota.—Eau Claire, 22; Duluth and Saint Paul, 20; Morris, 18; Albert Lea and Red Wing, 15; Northfield and Bird Island, 12; Saint Vincent, 8.7; Mankato, 6.

Missouri.—Conception, 2.

Montana.—Fort Maginnis, 20.5; Fort Assinaboine, 18.3; Helena, 12.

Nebraska.—Yutan, 5; Omaha, 2.2; De Soto, Hay Springs, Valentine, Genoa, and Tecumseh, 2; Tremont, Brownville, Weeping Water, Stromsburg, and Ashland, 1; Marquette, York, Stockham, and Tacoma, 0.5.

New Hampshire.—Mount Washington, 11; Antrim, 7 (in the woods); Nashua, 2.

New Jersey.—Paterson, 1; Beverly and Dover, trace.

New York.—Palermo, 15; Oswego, Penn Yan, and Coopers-town, 5; Auburn, and Le Roy, 4; Ithaca, 3; Humphrey, 2.5; Buffalo, 2; Rochester, 1.3; Albany, 1.

Ohio.—Garrettsville, 13.4; Toledo, 1.8; Wauseon, 1.5; Hiram, 1; Napoleon and Cleveland, 0.5; Sandusky, 0.3; Tiffin, trace.

Oregon.—East Portland, 4; La Grande, 3.

Pennsylvania.—Dyberry and Grampian Hills, 6; Erie, 3; Phillipsburg, 2; Pittsburg, 0.5; Catawissa and Quakertown, trace.

Vermont.—Poultney, 27; Strafford and Brattleborough, 24; Post Mills, 13; Newport, 10; Charlotte, 4 to 5; Burlington, 1.

Washington Territory.—Port Angeles, 5.5; Walla Walla, 3; Fort Spokane, 0.5.

Wisconsin.—Green Bay, 23; Embarras, 20; Wausau, 17; Fond du Lac, 13; Franklin, 12; Delavan, 11; Madison, 8; Milwaukee, 7; La Crosse, 5.

Wyoming.—Fort Bridger, 2.

HAIL.

Nashville, Tennessee: heavy rain, with thunder and lightning, occurred on the afternoon of the 13th; during the storm large hail stones fell from 6.20 to 6.32 p. m. Reports from Waverly, sixty-four miles west of Nashville, state that heavy hail fell from 5.40 to 5.50 p. m., the stones being the size of walnuts, and in some cases five inches in diameter. On the Hillsborough turnpike, four miles west of Nashville, hail as large as marbles fell.

Tatoosh Island, Washington Territory: on the 20th heavy rain fell during the greater part of the day; between 8.10 a. m. and 10.45 p. m. it was accompanied by a strong westerly gale which attained a maximum velocity of forty-five miles per hour. Between 4 and 4.10 p. m. heavy hail fell to a depth of half an inch, the stones consisted of irregularly shaped pieces of clear ice about one third of an inch in diameter.

Hail is also reported to have occurred, as follows:

Arizona.—Fort Verde, 22d.

Arkansas.—Little Rock, 22d.

California.—Anderson, 7th to 10th.

Connecticut.—Bethel, 17th.

Delaware.—Cape Henlopen, 5th.
Idaho.—Boisé City, 2d; Fort Cœur d'Alene, 13th, 15th, 26th, 27th.
Illinois.—Cairo, 13th.
Indiana.—Vevay, 23d.
Iowa.—Independence, 21st, 22d; Cedar Rapids, 22d.
Maine.—Cornish, 22d.
Massachusetts.—Westborough, 14th, 21st; Dudley, 15th, 24th.
Nebraska.—Tecumseh, 22d.
New Jersey.—Beverly, 5th, 29th; Salem, 24th.
New York.—West Point, 14th; Setauket, 15th.
North Carolina.—Raleigh, 5th, 17th; West Point, 12th.
Ohio.—Jacksonborough, 28th.
Oregon.—Astoria, 15th, 19th, 20th, 21st, 24th, 25th, 26th, 29th, 30th, 31st; Albany, 21st, 26th.
South Carolina.—Spartanburg, 9th.
Tennessee.—Austin, 13th, 29th; Milan, 17th, 22d.
Virginia.—University of Virginia, 13th.
Washington Territory.—Neah Bay, 14th, 15th, 16th, 20th, 21st, 24th, 30th.
Wisconsin.—Embarras, 21st.

Table of excessive and greatest monthly precipitation for January, 1887.

Station.	Specially heavy.		Largest monthly.	Amount.	Station.	Specially heavy.		Largest monthly.	Amount.
	Date.	Amt.				Date.	Amt.		
<i>Alabama.</i>					<i>N. Carolina—Con.</i>				
Greenville.....			7.55		Lenoir.....	23, 24	2.50		
Fayette.....			6.50		<i>Oregon.</i>				
Mount Vernon.....	23	2.18			Astoria.....	22, 23	2.75	18.24	
<i>California.</i>					Do.....	29, 30	4.28		
Fort Gaston.....	19, 20, 21	5.87	9.43		Do.....	18, 19	2.03	15.36	
Summit.....			6.25		Mount Angel.....	23, 24	2.90		
<i>Connecticut.</i>					Do.....	29, 30	3.10		
Middletown.....			7.07		Do.....	28, 29	2.82	12.58	
Voluntown.....			7.00		Portland.....	23	2.67	12.31	
Collinsville.....			6.10		Do.....	29, 30	2.19		
<i>Florida.</i>					Eola.....	29, 30	2.42	9.86	
Tallahassee.....	11, 12	2.70	6.20		Roseburg.....			8.64	
Jacksonville.....	13, 14	2.18			<i>Pennsylvania.</i>				
<i>Illinois.</i>					Fort Klamath.....	18, 19, 20	3.33		
Sandwich.....	21, 22	2.09			Phillipsburg.....			6.50	
South Evanston.....	21, 22	2.40			Zionsville.....	13, 14	3.10		
Geneseo.....	22	2.26			Wellsborough.....	23	2.00		
Waukegan.....	22	2.10			<i>Rhode Island.</i>				
Bevidero.....	22	2.00			Block Island.....	6	2.15	6.98	
Onida.....	22	2.13			Narragansett Pt.....			6.73	
Pekin.....	22	2.00			Providence.....			6.61	
Sycamore.....	22, 23	2.18			Bristol.....			6.39	
Lake Forest.....	23	2.04			Woonsocket.....			6.52	
Centerville.....	23	2.00			Olneyville.....			6.29	
<i>Louisiana.</i>					Providence.....			6.19	
Shreveport.....	28	2.00			<i>Tennessee.</i>				
<i>Maine.</i>					Waynesborough.....	23	3.10	6.65	
Eastport.....	1, 2	2.30			Do.....	28	2.05		
Orono.....			7.78		Festoria.....	23	3.00	6.40	
Gardiner.....	14, 15	2.18	7.56		Milan.....	22	2.04		
<i>Massachusetts.</i>			7.32		Do.....	28	2.10		
Fall River.....					Memphis.....	22, 23	3.11		
South Hingham.....			7.38		Chattanooga.....	23	3.48		
Taunton.....			7.34		Nashville.....	23	2.02		
Rowe.....			7.33		Do.....	29, 30	2.05		
New Bedford.....			7.30		Andersonville.....	23	2.00		
Wellesley.....			7.18		Parkville.....	23	2.50		
Cambridge.....			7.10		Grief.....	23	2.95		
Randolph.....			7.04		Farmingdale.....	23	2.62		
Gilbertville.....			6.96		Manchester.....	23	2.43		
Northampton.....			6.68		Beech Grove.....	23	2.10		
Milford.....			6.66		Hohenwald.....	23	2.80		
Blue Hill (base).....			6.46		Dickson.....	23	2.67		
Williamstown.....			6.36		Do.....	28	2.53		
Lynn.....			6.29		Trenton.....	23, 24	2.49		
Concord.....			6.20		Bolivar.....	28	2.80		
Beverly Farms.....			6.16		<i>Vermont.</i>				
Fitchburg.....			6.20		Brattleborough.....	14	2.03	6.58	
Somerset.....			6.12		Do.....			6.54	
New Bedford.....			6.08		Jacksonville.....			6.43	
<i>Michigan.</i>			6.02		<i>Virginia.</i>				
Grand Haven.....	22	2.67			Rappahanock.....	23, 24	2.18		
East Saginaw.....	22, 23	2.71			<i>Washington Ter.</i>				
<i>New Brunswick.</i>					Neah Bay.....	11, 12, 13	4.49	22.30	
Saint John.....			10.95		Do.....	25, 26	2.26		
Parker's Ridge.....			6.91		Do.....	29, 30	2.85		
<i>New Hampshire.</i>					Tatoosh Island.....	11, 12	2.44	14.46	
Woodstock.....			6.90		Pysht.....	13, 14	2.15	13.76	
<i>New Jersey.</i>					Fort Canby.....	14, 15	2.00	11.91	
Phillipsburg.....			6.65		Olympia.....			9.83	
Union.....			6.35		Port Angeles.....			6.20	
Dover.....			6.21		<i>Wisconsin.</i>				
<i>North Carolina.</i>					Madison.....	22, 23	2.48		
Hatteras.....			6.09		<i>Wyoming.</i>				
Flat Rock.....	23	3.12			Camp Sheridan.....			7.70	

SLEET.

Sleet fell in the various states and territories during the month, as follows:

Alabama.—5th.
Arizona.—22d.
Connecticut.—5th, 14th, 17th.
Florida.—5th.
Georgia.—5th, 7th, 17th.
Illinois.—12th, 13th, 23d, 25th, 26th, 31st.
Indiana.—28th.
Indian Territory.—7th.
Iowa.—21st, 22d, 23d.
Kansas.—7th.
Kentucky.—13th.
Louisiana.—9th.
Maine.—1st, 2d, 7th, 14th, 17th, 18th, 26th.
Maryland.—9th.
Massachusetts.—10th.
Michigan.—13th, 15th, 16th, 21st.
New Jersey.—5th, 24th, 26th.
New York.—1st, 14th, 17th, 22d.
North Carolina.—5th, 23d.
Ohio.—13th, 14th, 28th.
Pennsylvania.—1st, 14th.
South Carolina.—5th, 7th.
Tennessee.—9th, 17th, 26th.
Utah.—29th.
Vermont.—1st.
Wisconsin.—13th, 14th, 21st, 23d.

DROUGHT.

During the past summer, when other parts of Texas were suffering from drought, copious rainfalls occurred at San Antonio and over the surrounding country, but since the first of October, 1886, very little rain fell at that station, the total precipitation of the four months from October 1, 1886, to January 31, 1887, being only 1.36 inches. Water pools have dried and ranch men are forced to drive their stock five to ten miles for water. Grass in some sections has become parched and innutritious. Cattle men say that but for the abundant growth of cactus large numbers of cattle would have starved. At Fort Elliott, in the "Panhandle" district, one of the great cotton and cattle-raising sections of the state, during the months of November, December, and January only 0.28 inch of rain fell. Reports from Dallas, Fort Worth, Sherman, and Waco, situated in the midst of the grain-growing districts of the state, say that the wheat fields are dry and dusty. The observer at Rio Grande City states that a severe drought prevailed in that district during the month; in some places the ground was entirely bare and very dusty, and during high winds which occurred there on the 17th, 19th, 20th, 21st, 23d, and 27th, very heavy clouds of dust and sand filled the atmosphere.

The rainfall of the winter thus far has been small in Illinois; the observer at Windsor, Shelby county, states that this county has been much in need of rain since the drought began in July, and that numerous wells have become dry. The observer at Pekin, Tazewell county, says that many wells are dry and farmers are obliged to drive their cattle long distances for water.

WINDS.

The most frequent directions of the wind during January, 1887, are shown on chart ii by the arrows flying with the wind; they are also given in the table of miscellaneous meteorological data. In New England, the middle Atlantic states, the Lake region, and upper Mississippi valley, the wind blew generally from the west or northwest; in the west Gulf states the prevailing winds were from the south; in the Ohio Valley southwest; along the eastern slope of the Rocky Mountains the wind blew mostly from the west; in California northwesterly winds prevailed. In other parts of the country they were variable.

HIGH WINDS.

[In miles per hour.]

Wind-velocities of fifty or more miles per hour were recorded during the month, as follows:

Mount Washington, New Hampshire, 62, sw., 1st; 90, nw., 2d; 70, nw., 3d; 50, sw., 4th; 50, sw., 5th; 78, nw., 7th; 60, sw., 9th; 97, nw., 10th; 100, nw., 11th; 82, w., 12th; 92, nw., 13th; 78, se., 14th; 55, nw., 16th; 70, sw., 17th; 90, nw., 18th; 87, nw., 19th; 81, s., 20th; 132, w., 21st; 100, w., 22d; 97, w., 23d; 94, nw., 24th; 94, nw., 25th; 80, nw., 26th; 80, nw., 27th; 94, nw., 28th; 66, nw., 29th; 80, w., 30th; 71, nw., 31st.

Pike's Peak, Colorado, 70, nw., 1st; 52, n., 2d; 54, nw., 4th; 52, nw., 5th; 64, nw., 6th; 56, nw., 8th; 58, n., 9th; 64, w., 10th; 80, nw., 11th; 80, nw., 12th; 98, nw., 13th; 60, nw., 14th; 70, nw., 15th; 50, n., 16th; 62, nw., 17th; 72, nw., 18th; 78, w., 19th; 74, nw., 23d; 96, w. and nw., 24th; 64, w., 25th; 68, w., 26th; 76, w., 27th; 94, nw., 28th; 80, w., 29th; 76, w., 30th.

Fort Maginnis, Montana, 50, nw., 3d; 54, nw., 10th; 64, nw., 11th; 51, nw., 12th; 60, w., 20th.

Fort Bridger, Wyoming, 55, sw., 13th.

Eastport, Maine, 55, ne., 14th.

Fort Assinaboine, Montana, 56, w., 14th; 52, sw., 26th.
Fort Totten, Dakota, 53, nw., 15th; 60, nw., 29th.
Buffalo, New York, 58, sw., 17th and 20th.
Rochester, New York, 52, w., 17th; 50, w., 20th.
Chincoteague, Virginia, 56, nw., 17th; 52, nw., 24th.
Fort Canby, Washington Territory, 56, w., 20th.
Tatoosh Island, Washington Territory, 52, w., 27th.
Denver, Colorado, 56, nw., 28th; 56, w., 29th.
Fort Stanton, New Mexico, 51, nw., 29th.

TORNADO STUDIES FOR JANUARY 1887.

[Prepared by Lieut. JOHN P. FINLEY, Signal Corps, U. S. Army, Assistant.]

During the month of January, 1887, there were furnished to the Chief Signal Officer, by tornado reporters for the Signal Service, records of the occurrence of twelve tornadoes.

These storms were distributed as follows: Alabama, one; Tennessee, two; Texas, two; South Carolina, three; North Carolina, two; and New York, two.

The tracks of the tornadoes here mentioned are graphically shown on chart number i (tracks of low pressure areas) of this REVIEW.

Further consideration of these storms will appear in the following tables, which are self-explanatory:

Relation of tornado regions to areas of low barometer, January, 1887.

Date of tornado.	Time.	Location.	Barometric depression—central region.				Tornado region.				Velocity of southerly winds—miles per hour.	Distance of maximum velocity from tornado region.	Velocity of northerly winds—miles per hour.	Distance of maximum velocity from tornado region.	Temperature gradients per geographical degree.			
			Time (75th meridian.)	Lowest barometer.	Form.	Ratio of axes.	Departure from normal.	Location.	Direction and distance (in miles) from central area of barometric minimum.	Time (75th meridian.)					Maximum current temperature gradient.	Mean current temperature gradient.	Normal temperature gradient.	Departure from normal.
January 13.	a. m.	Central Missouri.	7 a. m.	29.40	Mississippi to Montana.	8 to 4	—0.83	Southwest Alabama.	se. 435	6 to 16	Miles. 20	5 to 20	1000	7 a. m.	7.66	7.16	3.53	4.14
13.	6 p. m.	Southern Illinois.	3 p. m.	29.31	Gulf of Mexico to Minnesota.	7 to 4	—0.83	Southern Tennessee.	se. 460	5 to 30	250	5 to 41	1200	3 p. m.	3.96	2.46	2.96	1.00
13.	6 p. m.	Southern Illinois.	3 p. m.	29.31	Gulf of Mexico to Minnesota.	7 to 4	—0.83	Northern Tennessee.	se. 460	5 to 30	250	5 to 41	1200	3 p. m.	3.96	2.46	2.96	1.00
22.	7 a. m.	Northwest Texas.	7 a. m.	29.47	Southern New Mexico to Lake Superior.	10 to 3	—0.61	Northeast Texas.	se. 210	5 to 23	144	5 to 17	435	7 a. m.	9.07	7.69	2.94	6.13
22.	About 4 a. m.	Northwest Texas.	7 a. m.	29.47	Southern New Mexico to Lake Superior.	10 to 3	—0.61	Northeast Texas.	se. 210	5 to 23	144	5 to 17	435	7 a. m.	9.07	7.69	2.94	6.13
23.	Afternoon.	Lake Huron	3 p. m.	29.47	Gulf of Mexico to Lake Huron.	9 to 3	—0.54	Northwest South Carolina.	s. 530	5 to 22	250	5 to 22	425	3 p. m.	10.35	7.50	3.28	7.07
23.	Afternoon.	Lake Huron	3 p. m.	29.47	Gulf of Mexico to Lake Huron.	9 to 3	—0.54	Northwest South Carolina.	s. 530	5 to 22	250	5 to 22	425	3 p. m.	10.35	7.50	3.28	7.07
24.	a. m.	Upper Canada.	7 a. m.	29.30	Georgia to mouth of St. Lawrence River.	10 to 3	—0.74	Northern Carolina.	sw. 700	5 to 34	180	7 to 32	460	7 a. m.	15.10	10.39	2.85	13.25
25.	4 a. m.	Lake Huron	7 a. m.	29.50	Southwest Texas to Lake Huron.	10 to 3	—0.56	Western Carolina.	sw. 540	5 to 24	300	5 to 22	540	7 a. m.	12.10	7.55	2.85	9.29
30.	5 p. m.	Lower Canada.	3 p. m.	29.24	Kentucky to Lower Canada.	4 to 3	—0.77	Northwest New York.	sw. 200	5 to 22	75	5 to 31	200	3 p. m.	12.86	11.13	3.56	9.30
30.	4.50 p. m.	Lower Canada.	3 p. m.	29.24	Kentucky to Lower Canada.	4 to 3	—0.77	Southwest New York.	sw. 200	5 to 22	75	5 to 31	200	3 p. m.	12.86	11.13	3.56	9.30
30.	9 p. m.	Lower Canada.	3 p. m.	29.24	Kentucky to Lower Canada.	4 to 3	—0.77	Northwest Carolina.	s. 650	5 to 22	300	5 to 31	400	3 p. m.	12.86	11.13	4.37	8.49

Report of tornadoes for the month of January, 1887.

Place.	Date.	Time.	Direction.	Form of cloud.	Number of persons killed.	Number of persons wounded.	Width of path.	Number and kind of animals killed.	Number and kind of buildings destroyed.	Total valuation of property destroyed.	Authority.
Sim's Chapel, Alabama.....	13	A. M.....	ne.	Funnel	.....	.....	Feet. 1,320	Great loss of stock.	.....	Many thousands of dollars.	Saint Louis: "Globe-Democrat."
Chapel Hill, Tennessee.....	13	6 p. m.....	ne.	Funnel	None.	Several	1,320	Many	Many	Many thousands of dollars.	E. D. Thompson, Marshall county, and C. Foster Williams, Ashwood, Tennessee.
Near Greenbrier, Tennessee.....	13	6 p. m.....	Easterly	Funnel	.....	.....	1,320 to 2,540	.....	Many	Very destructive.	Martin Walter, Cross Plains, Tennessee.
Brookston, Texas.....	22	7 p. m.....	ne.	Funnel	.....	.....	.....	.....	One church, several houses, number of barns.	Many thousands of dollars.	Saint Louis: "Globe Democrat."
Near Brazos, and three miles west of Millsap, Texas.	22	About 4 a. m.	ne.	Funnel	None.	None.	2,640	.....	Very destructive.	.....	H. M. Harrison, Millsap, Texas.
Anderson's Mills, South Carolina.	23	Afternoon	Easterly	Funnel	.....	.....	.....	.....	Very destructive.	.....	Geo. E. Ladshaw, Pacolet, South Carolina.
Near Fairview, South Carolina.	23	Afternoon	Easterly	.....	.....	.....	.....	.....	Very destructive.	.....	Geo. E. Ladshaw, Pacolet, South Carolina.
Graham and Company shops, North Carolina.	24	A. M.....	Easterly	.....	None.	None.	1,320	None.	Many	.....	A. T. Smith, Altamahaw, North Carolina.
Four miles south of Catawba, North Carolina.	25	4 a. m.....	e. ne.	.....	None.	None.	600	None.	Very destructive to timber	.....	G. C. McNeill, Catawba, North Carolina.
Pultneyville, New York	30	5 p. m.....	ne.	Funnel	None.	None.	600	None.	Cloud mostly on Lake Ontario.	.....	M. A. Veeder, Lyons, New York.
Twenty miles west of East Otto, New York.	30	4.20 p. m.....	ne.	Column of smk.	.....	.....	Narrow	.....	.....	.....	Orville L. Larkin, East Otto, New York.
Burnt Factory, South Carolina.	30	9 p. m.....	ne.	.....	None.	None.	Narrow	.....	Many farm buildings.	.....	F. C. Sexton, Burnt Factory, South Carolina.

TEMPERATURE OF WATER.

The following table shows the highest and lowest temperatures of water observed at the several stations; the monthly ranges of water temperature; the average depth at which the observations were made; and the mean temperature of the air:

Temperature of water for January, 1887.

Station.	Temperature at bottom.		Range.	Average depth, feet and tenths.	Mean temperature of the air at station.
	Max.	Min.			
Alpens, Michigan a.....	.....	.....	.....	.....	.....
Augusta, Georgia.....	49.2	36.2	13.0	7.7	41.8
Baltimore, Maryland b.....	39.3	32.3	4.0	12.0	32.4
Boston, Massachusetts.....	34.5	29.2	5.3	23.9	25.9
Buffalo, New York a.....	.....	.....	.....	.....	.....
Canby Fort, Washington Territory.....	45.2	43.0	2.2	15.7	44.9
Cedar Keys, Florida.....	62.5	46.1	16.4	7.5	50.3
Charleston, South Carolina.....	52.9	42.7	10.2	35.4	45.6
Chicago, Illinois c.....	33.0	32.5	0.5	8.8	17.3
Chincoteague, Virginia d.....	44.0	30.0	14.0	2.6	35.2
Cleveland, Ohio e.....	34.5	32.2	2.3	13.0	24.9
Detroit, Michigan a.....	.....	.....	.....	.....	.....
Duluth, Minnesota a.....	.....	.....	.....	.....	.....
Eastport, Maine.....	40.0	36.1	3.9	15.5	20.5
Escanaba, Michigan.....	.....	.....	.....	.....	.....
Galveston, Texas.....	57.6	39.4	18.2	13.6	51.2
Grand Haven, Michigan f.....	32.4	32.2	0.2	18.0	20.1
Jacksonville, Florida.....	59.1	47.6	11.5	18.0	49.8
Key West, Florida.....	74.7	60.4	14.3	18.3	66.5
Mackinaw City, Michigan a.....	.....	.....	.....	.....	.....
Marquette, Michigan a.....	.....	.....	.....	.....	.....
Mobile, Alabama.....	47.5	36.1	11.4	15.3	47.6
New London, Connecticut g.....	43.1	34.5	8.6	11.2	28.6
New York City.....	35.0	30.7	4.3	14.7	30.1
Norfolk, Virginia.....	43.1	33.4	9.7	15.4	39.4
Pensacola, Florida.....	57.3	45.5	11.8	17.0	49.1
Portland, Maine.....	33.5	30.0	3.5	17.0	18.7
Portland, Oregon.....	47.5	41.2	6.3	56.9	42.8
Sandusky, Ohio a.....	.....	.....	.....	.....	.....
San Francisco, California.....	52.7	50.7	2.0	37.1	51.8
Savannah, Georgia.....	51.0	39.4	11.6	9.8	46.3
Toledo, Ohio h.....	34.4	32.4	2.0	15.8	31.9

a Frozen throughout the month.

b Frozen 4th, 9th, 10th, 19th, 20th.

c Frozen from 1st to 26th, 30th, 31st.

d Frozen 3d, 4th, 5th.

e Frozen from 1st to 24th.

f Frozen from 1st to 22d, and 31st.

g Frozen 4th, 5th.

h Frozen from the 1st to 23d.

INLAND NAVIGATION.

STATE OF WATER IN RIVERS AND HARBORS.

The Mississippi River at Cairo, Illinois, was frozen over from the 1st to the 19th, the ice being of sufficient firmness as to allow heavy wagons to cross; on the 3d a channel was cut through the ice from Bird's Point, Missouri, to Cairo, to be used by the railroad transfer boats. An ice gorge formed at Bird's Point, Missouri, on the 7th and broke on the 20th, the

heavy ice passing out rapidly but doing no damage, as upon the first indications of the movement all river craft moved into safe quarters at the mouth of the Ohio River. On the 21st river men reported the Mississippi River clear of ice from Cairo, to Grand Tower, Illinois. On the 22d an ice gorge which had formed at Fountain Bluff, Illinois, five miles above Grand Tower, broke, but did no damage to the numerous boats and barges in winter quarters at the latter place. The river rose steadily on the 24th, 25th, and 26th, and was filled with heavy floating ice, but on the 27th it was sufficiently clear to allow navigation between Cairo, Illinois, and Saint Louis, Missouri, to be resumed. At La Crosse, Wisconsin, Dubuque, Davenport, and Keokuk, Iowa, and intervening points, the river was frozen solid throughout the month. At Saint Louis, Missouri, on the 1st, heavy floating ice gorged south of the bridge which crosses the river at this city, and remained so until the 24th, when it broke, and the ice began moving down. On the 25th the river was free of ice at this place. On the 27th a heavy gorge that had formed above the bridge broke, being forced down by ice from above. On the 28th, 29th, 30th, and 31st heavy ice passed down, filling the river from bank to bank, but steamboat navigation was generally being resumed.

On the 2d heavy floating ice in the Ohio River rendered navigation between Cairo and northern points impossible; the river continued in the same state until the 14th, when the ice became so soft as to offer but little impediment to navigation. On the 15th the river between Cairo and Paducah, Kentucky, was comparatively free of ice, but above that point heavy ice was reported as filling the river from bank to bank. On the 21st the steamer "Guiding Star" arrived at Cairo from Cincinnati. The captain reported the ice as very heavy north of Evansville, Indiana, and that he experienced great difficulty in getting through. The voluntary observer at Portsmouth, Ohio, reports heavy flowing ice in the Ohio River from the 2d to 13th, and from the 18th to 24th, during which time navigation was practically closed at that point. At Louisville, Kentucky, the river was filled with floating ice on the 2d and 3d, rendering navigation difficult; from the 4th to 9th it was entirely suspended owing to the heavy drift ice. From the 10th to 19th navigation was partially suspended; from the 20th to the end of the month the river was tolerably clear of ice."

The Alleghany and Monongahela rivers at Pittsburgh, Pennsylvania, were filled with floating ice from the 1st to 15th, and from the 17th to 29th. On the 19th and 20th two heavy ice gorges, each nearly two miles long, formed in the Monongahela

River, between Monongahela City and Elizabeth, causing the river to rise rapidly and threatening to inundate the surrounding country. On the 23d and 24th a heavy ice gorge in the Alleghany River broke away and did considerable damage to boats tied up at Pittsburg and other places. Three barges were carried away from the landing at Freeport, and a number of rafts, boats, and barges, between that point and the 43d street bridge, were destroyed. The water in the river at Pittsburg reached its highest point on the 25th, when it was 16.1 feet above the low-water mark on the gauge.

Baltimore, Maryland: ice began forming rapidly in the harbor on the 3d; on the 4th it presented a serious obstacle to navigation, the harbor being covered with ice two to five inches in thickness. The same difficulty was experienced throughout the month, keeping ice boats busy breaking the ice.

Lynchburg, Virginia: the James River was frozen over at this point from the 3d to 25th.

Rochester, New York: the ice in the Genesee River broke up on the morning of the 24th and began flowing into the lake, doing no damage.

Milwaukee, Wisconsin: navigation between this point and east shore ports, by regular line steamers, was frequently interrupted during the month by heavy ice in the lake.

Leavenworth, Kansas: the Missouri River was frozen over at this point from the 1st to 31st; numerous reports from stations on the Missouri River, north of Leavenworth, show that the river was frozen over throughout the month.

In the following table are shown the danger-points at the various river stations; the highest and lowest depths for January, 1887, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, January, 1887.

[Expressed in feet and tenths.]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, Louisiana.....	29.9	30, 31	5.1	22, 23	1.8	3.3
<i>Arkansas River:</i>						
Fort Smith, Arkansas.....	22.0	29	2.0	17	0.6	1.4
Little Rock, Arkansas.....	23.0	25	3.9	19, 20, 21	1.1	2.8
<i>Missouri River:</i>						
Yankton, Dakota.....	24.0					
Omaha, Nebraska.....	18.0					
Leavenworth, Kansas.....	20.0					
<i>Mississippi River:</i>						
Saint Paul, Minnesota.....	14.5					
La Crosse, Wisconsin.....	24.0					
Dubuque, Iowa.....	16.0					
Davenport, Iowa.....	15.0					
Keokuk, Iowa.....	14.0					
Saint Louis, Missouri.....	32.0	26	11.0	31	6.8	4.2
Calto, Illinois.....	40.0	31	32.6	19, 20	10.9	21.7
Memphis, Tennessee.....	34.0	31	22.6	19, 20	7.6	15.0
Vicksburg, Mississippi.....	41.0	5, 6	17.0	22, 23	8.0	9.3
New Orleans, Louisiana.....	13.0	7	4.7	24, 26	2.3	2.4
<i>Ohio River:</i>						
Pittsburg, Pennsylvania.....	22.0	25	16.1	10 to 14	2.8	13.3
Cincinnati, Ohio.....	50.0	30	43.0	10	11.5	31.5
Louisville, Kentucky.....	25.0	31	20.2	20	5.8	14.4
<i>Chesapeake River:</i>						
Nashville, Tennessee.....	40.0	30	36.9	13	6.4	30.5
<i>Tennessee River:</i>						
Knoxville, Tennessee.....	25.0	25	13.4	23	2.7	10.7
Chattanooga, Tennessee.....	33.0	20	21.8	13, 14	5.0	16.8
<i>Massachusetts River:</i>						
Pittsburg, Pennsylvania.....	29.0	25	16.1	11 to 14	2.8	13.3
<i>Savannah River:</i>						
Augusta, Georgia.....	32.0	26	11.3	21, 22, 23	6.5	4.8
<i>Mobile River:</i>						
Mobile, Alabama.....		7	16.9	1	13.8	3.1
<i>Sacramento River:</i>						
Red Bluff, California.....		21	6.2	10 to 14	1.0	5.2
Sacramento, California.....		23	13.2	13 to 16	9.0	4.2
<i>Willamette River:</i>						
Portland, Oregon.....		31	14.7	10, 11	4.5	10.2
<i>Colorado River:</i>						
Yuma, Arizona.....						

a Frozen throughout the month.

FLOODS.

Port Deposit, Cecil county, Maryland: during the latter part of the month the heavy ice in the Susquehanna River became badly gorged in the neighborhood of this place, causing a rapid rise in the river at points above the gorge. On the 28th a large number of houses in the lower end of the town

was submerged; the houses were also injured by floating ice, lumber, and other debris. On the above date the river was free of ice from the Philadelphia, Wilmington, and Baltimore Railroad bridge to the Chesapeake Bay, between this bridge and the Baltimore and Ohio Railroad bridge the ice was solid, and eight inches thick; above the latter bridge the ice for a distance of ten miles was gorged. At McCall's Ferry, thirty-eight miles above Port Deposit, the ice was gorged for a distance of four miles. On the 29th heavy rain fell all day and the water in the river continued to rise, the main street of Port Deposit became flooded to a depth of four feet, and all communication by railroad was entirely cut off. Several unsuccessful attempts were made to break up the gorge by the use of dynamite. On the 27th and 28th travel at all points on the Delaware, Lackawanna, and Western Railroad between Wilkesbarre and Kingston, Pennsylvania, was suspended on account of the high water, which covered the track in some places to a depth of three feet. On the 30th a large gorge formed at Port Griffith, near Wilkesbarre, causing the river to overflow its banks and submerge all the low land in the vicinity; in some places the water rose to the second story of small houses located on the river bank. At the end of the month the river was still gorged with ice at numerous points.

Reading, Pennsylvania: on account of heavy rains all small streams in the vicinity of the Schuylkill River were much swollen on the 24th. A large ice gorge formed near Shoemakersville, above Reading, causing the river to overflow the surrounding country.

Mifflintown, Juniata county, Pennsylvania: on the 24th and 25th high temperature and heavy rain prevailed, melting the snow that covered the ground and causing the Juniata River to rise rapidly. On the morning of the 25th the ice in the river began moving; during the day a gorge formed below the town, causing the river to overflow its banks and carry away miles of fencing and numerous out-buildings.

Port Jervis, Orange county, New York: on the night of the 24-25th the ice in the Lackawaxen Creek broke up, but gorged at Hawley, Wayne county, Pennsylvania, submerging the lower part of the town. On the 25th the ice in the Delaware River gorged at Rosetown, three miles below this place, and flooded a large area of farming country, in some places to a depth of four feet.

Canajoharie, Montgomery county, New York: on the 23d and 24th the ice in the Mohawk River and its tributaries began breaking up and floating down the river, gorging in numerous places against bridges or other obstructions. On the 24th large masses of ice were heaped against the West Shore Railroad bridge at this place, causing the river to overflow its banks and flood large areas of farming land.

Buffalo, New York: on the 23d light rain, with heavy wind and high temperature, prevailed, breaking up the ice in the Buffalo River, and flooding the lower parts of the city. During the night of the 23d-24th the river overflowed its banks, submerging about three thousand acres of land and doing considerable damage by flooding cellars and floating away fences and small frame buildings.

Toledo, Ohio: warm weather and light rain prevailed during 22d and 23d; this, in addition to a high southerly wind on the early morning of the 23d, caused the ice in the Maumee River to break up rapidly. During the afternoon a gorge formed in the river one mile below this point and the water began rising rapidly, flooding the lower part of the city. The trestle work of the Union railroad bridge was carried away by the ice on the afternoon of the 23d; on the 24th the Pennsylvania railroad bridge was damaged in the same way. On the 25th the river was clear of ice and the flood had subsided.

Wabash, Indiana: owing to the comparatively high temperature and heavy rains which prevailed on the 22d and 23d the ice in the upper part of the Wabash River broke up and began moving on the night of the 23d-24th. Small gorges formed in the river at numerous places, causing floods which did considerable damage; in Wells county several costly bridges were

Table of miscellaneous meteorological data for January, 1887—Signal Service observations.

Stations.	Elevation above level.	Atmospheric pressure (in inches and hundredths).						Temperature of the air (in degrees Fahrenheit).										Winds.																		
		Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes.		Monthly range of barometer.	Monthly mean.	Departure from normal.	Extremes.		Daily ranges.		Mean rel. humidity.	Mean dew-point.	Precipitation.	Departure from normal.	Total movement.	Prevailing direction.	Maximum velocity.																
					Highest barometer.	Lowest barometer.				Max.	Min.	Greatest.	Least.							Miles p. h.	Direction.															
																						Date.	Date.	Date.	Date.	Date.	Date.									
New England.																																				
Eastport	29.89	—	—	29.97	30.68	4	29.19	24	1.45	20.5	+1.5	50.3	1	31.0	—13.4	19	9.9	63.7	44.3	18	5.8	16	79.9	14.9	7.78	—	4.03	8,481	nw.	55	de.	14	21	12	14	5
Portland	99	29.86	—	29.97	30.68	4	29.19	24	1.45	18.7	—4.5	47.2	23	26.9	—14.7	19	9.3	61.9	34.6	28	3.8	13	82.9	14.0	3.89	—	0.50	6,113	n.	32	n.	14	15	11	15	8
Mount Washington	6,279	23.32	—	29.91	30.75	4	29.15	24	1.60	5.6	+0.2	36.8	23	16.6	—35.4	19	7.1	72.2	50.0	2	7.3	23	63.1	4.4	4.27	—	0.01	29,175	nw.	132	w.	21	21	5	18	2
Boston	124	29.86	—	29.99	30.66	4	29.20	24	1.40	25.9	—0.4	55.9	29	34.4	—5.0	19	15.7	60.9	35.0	28	6.3	30	73.1	18.0	4.86	—	0.42	9,850	w.	48	e.	14	12	13	11	7
Block Island	27	29.98	—	30.00	30.62	4	29.25	24	1.37	31.4	+1.0	50.1	24	39.0	—1.8	19	23.0	54.3	31.3	18	5.5	30	86.1	27.6	6.98	—	1.32	13,822	sw.	44	sw.	29	15	11	14	6
Narragansett Pier	107	29.91	—	30.02	30.65	4	29.31	24	1.30	28.0	—2.2	51.1	24	33.7	—5.4	19	19.3	50.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
New Haven	47	29.91	—	30.02	30.65	4	29.31	24	1.30	28.6	—2.2	51.1	24	33.7	—5.4	19	19.3	50.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
New London	47	29.92	—	29.96	30.59	4	29.27	24	1.32	28.6	+0.1	50.4	23	39.3	—0.1	19	15.9	56.5	33.5	18	4.2	30	77.2	23.0	4.73	—	0.33	5,283	n.	34	sw.	29	14	8	16	7
Nantucket	14	30.00	—	30.03	30.63	27	29.34	17	1.28	32.5	—	54.3	20	40.3	—5.2	19	24.8	49.1	29.8	19	4.8	8	84.6	28.3	2.97	—	—	9,175	nw.	33	nw.	25	16	12	11	8
Edgartown	—	—	—	—	—	—	—	—	—	30.4	—	52.3	20	39.2	—0.3	19	21.6	52.0	36.2	27	7.1	5	—	—	—	—	—	—	—	—	—	—	—	—	—	
Vineyard Haven	—	—	—	—	—	—	—	—	—	32.2	—	50.5	23	41.5	—0.4	19	22.9	50.9	37.1	2	7.1	13	—	—	—	—	—	—	—	—	—	—	—	—	—	
Mid. Atlantic States.																																				
Albany	85	29.95	—	30.04	30.75	4	29.34	17	1.41	20.9	—1.9	50.2	24	31.8	—15.3	19	10.2	65.5	36.6	26	10.1	6	74.7	13.9	3.02	—	0.18	5,404	n.	33	n.	22	13	11	16	4
New York City	168	29.87	—	30.04	30.65	4	29.41	17	1.24	30.1	+0.4	50.2	23	37.5	—6.0	19	22.8	50.6	28.2	23	5.4	30	70.7	21.3	4.19	—	0.44	6,970	nw.	32	nw.	17	11	11	12	8
Philadelphia	117	29.95	—	30.07	30.66	4	29.42	17	1.24	31.5	—0.2	50.2	23	39.5	—8.1	19	23.7	57.5	29.4	20	8.0	6	68.7	21.8	3.23	—	0.26	8,431	nw.	41	nw.	24	13	8	15	8
Atlantic City	13	30.06	—	30.06	30.64	4	29.42	17	1.22	31.4	—0.3	49.4	14	38.2	—7.0	19	24.1	42.4	27.9	26	4.9	30	81.6	26.3	3.50	—	0.44	7,210	sw.	32	sw.	24	9	8	11	12
Cape Henlopen	—	—	—	—	—	—	—	—	—	37.9	—	53.0	29	39.7	—3.0	19	33.0	54.0	25.2	19	4.2	31	—	—	—	—	—	—	—	—	—	—	—	—	—	
Baltimore	45	30.02	—	30.06	30.66	4	29.45	17	1.20	32.4	—1.7	50.3	23	40.3	—7.3	19	25.1	58.0	25.2	25	8.9	5	68.4	22.5	2.57	—	0.68	4,596	nw.	28	nw.	7	10	7	16	8
Washington City	106	29.97	—	30.07	30.66	4	29.47	17	1.18	32.9	+0.2	50.7	23	41.3	—6.2	19	23.5	61.0	26.0	12	12.1	21	67.9	22.6	2.39	—	1.12	4,761	n.	28	nw.	17	9	6	14	11
Cape Henry	—	—	—	—	—	—	—	—	—	40.3	—0.2	50.4	23	42.2	—13.5	19	31.4	55.9	34.5	27	4.5	5	—	—	—	—	—	—	—	—	—	—	—	—	—	
Chincoteague	8	30.07	—	30.06	30.62	3	29.44	17	1.18	35.2	+1.3	58.5	21	42.8	—10.0	19	27.5	48.5	22.9	26	7.4	7	78.3	29.1	3.50	—	1.29	11,090	nw.	56	nw.	17	12	6	15	10
Lynchburg	652	29.38	—	30.08	30.65	4	29.02	14	1.03	35.4	—0.9	55.4	23	44.8	—6.1	19	20.3	59.3	29.0	25	6.8	9	70.2	25.7	2.04	—	1.83	3,336	sw.	25	w.	17	11	9	13	7
Norfolk	30	30.08	—	30.09	30.61	3	29.49	17	1.12	39.4	—1.0	59.0	23	48.3	—12.6	19	39.1	59.4	32.2	12	4.8	8	77.5	31.4	3.04	—	0.33	5,722	sw.	29	sw.	20	11	9	15	7
South Atlantic States.																																				
Charlottesville	808	29.26	—	30.11	30.61	4	29.70	10	0.90	38.2	—2.3	68.9	31	47.2	—8.2	4	29.4	60.7	28.1	19	4.9	5	67.3	27.2	2.39	—	3.91	3,480	sw.	24	nw.	18	12	5	17	9
Hatteras	12	30.13	—	30.12	30.59	27	29.64	1	0.96	44.7	+1.3	65.6	23	52.1	—19.8	19	33.8	45.8	28.8	13	5.9	9	81.9	39.3	6.09	—	0.58	11,256	n.	41	w.	24	15	9	11	11
Kitty Hawk	9	—	—	—	—	—	—	—	—	41.0	—0.9	69.7	22	48.6	—14.8	19	33.5	51.9	38.1	20	4.4	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Baleigh	439	29.66	—	30.15	30.64	4	29.63	17	1.01	38.5	—	69.0	23	47.5	—8.4	4	29.4	60.6	29.0	28	5.0	5	76.8	31.1	3.04	—	—	—	—	—	—	—	—	—		
Smithville	34	—	—	—	—	—	—	—	—	43.2	—3.1	66.6	24	50.1	—12.0	19	35.3	52.0	34.0	1	4.8	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Wash. Woods	—	—	—	—	—	—	—	—	—	41.9	—	66.6	24	50.1	—12.0	4	33.7	54.0	32.0	24	5.0	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Wilmington	32	30.09	—	30.12	30.58	27	29.67	10	0.91	44.2	—2.8	73.0	22	53.4	—14.6	19	34.1	58.4	34.6	28	6.8	5	73.6	35.6	3.30	—	0.73	6,164	sw.	34	nw.	24	13	6	14	11
Charleston	52	30.12	—	30.14	30.53	4	29.69	10	0.84	45.6	—3.4	69.6	23	53.4	—16.7	4	37.9	59.9	34.8	16	4.6	8	78.8	38.6	4.30	—	0.09	6,056	n.	29	sw.	14	13	6	16	9
Augusta	183	29.99	—	30.10	30.57	3	29.76	13	0.80	41.8	—5.0	73.7	23	53.1	—14.7	4	31.6	59.0	39.1	31	4.1	3	78.1	34.1	3.87	—	0.76	3,373	w.	19	nw.	18	9	8	7	16
Savannah	87	30.9	—	30.16	30.51	27	29.74	10	0.78	46.3	—4.9	70.7	17	54.9	—10.0	4	37.1	54.7	30.1	28	3.0	8	69.6	35.4	3.71	—	0.11	6,287	n.	29	nw.	18	14	6	13	12
Jacksonville	43	30.14	—	30.15	30.48	19	29.76	10	0.72	49.8	—5.8	76.3	31	59.8	—21.9	4	40.9	54.4	31.6	28	6.4	6	82.6	44.2	4.34	—	0.74	4,325	nw.	30	nw.	17	17	7	12	12
Florida Peninsula.																																				
Cedar Keys	22	30.20	—	30.18	30.50	19	29.81	10	0.70	50.3	—6.4	70.0	31	58.1	—24.0	4	42.2	46.0	26.3	1	6.9	7	85.1	45.7	1.31	—	3.43	6,882	w.	39	nw.	18	10	4	13	14
Key West	22	30.14	—	30.12	30.50	19	29.80	10	0.70	65.5	—3.4	78.8	29	72.2	—50.2	4	41.1	28.6	14.2	6	6	12	83.1	61.0	0.77	—	1.03	8,435	n.	42	nw.	1	6	4	15	12
Sanford	25	30.13	—	30.12	30.45	19	29.69	10	0.76	55.9	—1.1	79.9	29	66.0	—31.7	2	45.9	48.2	23.5	12	6.1	6	74.4	46.8	1.32	—	0.92	5,374	n.	28	nw.	17	9	8	9	14
Eastern Gulf States.																																				
Atlanta	1,129	28.96	—	30.15	30.54	27	29.70	13	0.84	39.6	—3.0	68.8	31	48.5	—9.0	2	31.1	59.8	27.8	19	4.5	9	73.2	30.5	3.52	—	3.82	8,661	nw.	32	w.	17	12	6	14	11
Pensacola	30	30.15	—	30.14	30.46	3	29.71	13	0.75	49.1	—3.4	72.0	31	55.0	—20.3	3	41.9	48.0	25.9	19	3.8	29	78.4	42.0	3.60	—	1.89	5,505	n.	28	n.					

Table of miscellaneous meteorological data for January, 1887—Signal Service observations—Continued.

Stations.	Elevation above level.	Atmospheric pressure (in inches and hundredths).				Temperature of the air (in degrees Fahrenheit).												Winds.			
		Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes.		Monthly mean.	Departure from normal.	Extremes.		Monthly range.	Daily ranges.		Mean rel. humidity.	Mean dew-point.	Precipitation.	Departure from normal.	Total movement.	Prevailing direction.	Maximum velocity.	
					Highest barometer.	Lowest barometer.			Max.	Min.		Greatest.	Least.							Miles p. h.	Direction.
Upper Min. Valley.																					
Saint Paul	831	29.06	-.09	30.02	30.69	29.16	30.153	1.0	11.4	31.5	27	11.7	35.7	18	10.2	67.2	47.0	21	8.7	13	78.8
La Crosse	725	29.21	-.07	30.03	30.65	29.09	30.150	10.7	4.7	41.0	27	20.8	28.9	7	1.2	69.9	37.4	21	6.0	10	73.3
Dayton	645	29.33	-.11	30.04	30.64	29.23	30.141	13.2	7.7	50.3	24	26.4	25.6	7	2.8	75.9	39.4	21	12.0	23	79.2
Des Moines	665	29.36	-.11	30.04	30.73	29.29	30.144	11.5	8.4	41.8	29	21.7	24.5	7	0.6	60.3	43.3	19	6.3	13	81.7
Dubuque	606	29.36	-.10	30.04	30.69	29.32	30.138	10.6	7.5	41.5	29	20.9	21.5	7	0.4	73.0	39.6	11	6.5	12	82.6
Keokuk	618	29.35	-.10	30.04	30.71	29.27	30.144	19.1	4.4	55.3	22	20.9	18.5	7	9.1	73.8	36.2	19	6.8	31	78.6
Calmar	359	29.70	-.09	30.06	30.68	29.34	30.134	33.4	1.1	66.1	20	41.3	1.1	2	34.9	67.2	37.0	17	4.7	22	69.1
Springfield	644	29.34	-.11	30.04	30.69	29.33	30.130	23.4	2.6	61.0	22	34.0	18.2	2	12.9	79.2	34.8	11	11.3	14	89.7
Saint Louis	571	29.43	-.12	30.04	30.69	29.31	30.137	30.8	0.3	65.6	20	41.2	9.6	2	20.5	75.2	35.6	30	9.2	31	66.9
Missouri Valley.																					
Lebanon	1,028	29.14	-.11	30.06	30.77	29.40	30.137	30.7	4.2	60.2	21	31.3	15.5	9	10.5	75.7	37.0	15	8.0	5	70.2
Leavenworth	842	29.14	-.11	30.06	30.77	29.40	30.137	30.7	4.2	60.2	21	31.3	15.5	9	10.5	75.7	37.0	15	8.0	5	70.2
Omaha	1,113	28.54	-.10	30.08	30.82	29.34	30.148	11.8	7.8	51.1	24	23.9	21.9	2	0.4	73.0	43.1	29	9.2	5	70.7
Valentine	2,604	27.16	-.09	30.08	30.75	29.07	30.168	15.0	...	49.5	20	38.6	30.0	2	1.6	79.5	44.2	9	12.1	25	70.8
Huron	1,307	28.57	-.13	30.06	30.88	29.04	30.184	0.4	7.1	38.5	20	13.9	49.8	8	12.8	81.0	34.8	8	11.8	17	76.9
Yankton	1,234	28.84	-.13	30.03	30.80	29.14	30.066	7.8	6.3	47.4	20	30.0	29.1	8	3.7	76.5	44.3	20	8.8	13	73.6
Northern slope.																					
Fort Assinaboine	2,690	26.98	-.23	29.94	30.69	29.20	12.149	9.3	0.2	43.2	14	20.4	35.0	6	5.9	78.2	51.0	22	10.8	9	64.0
Fort Custer	3,040	26.67	-.15	29.94	30.68	29.06	19.172	10.5	2.1	40.7	14	27.2	30.1	8	4.7	76.8	51.5	5	10.9	2	80.3
Fort Maginnis	4,320	25.28	-.20	29.81	30.54	29.09	19.145	18.5	3.0	47.3	14	28.3	26.5	31	3.3	78.4	45.4	6	8.1	12	69.6
Helena	4,099	25.62	-.26	29.89	30.59	29.16	19.134	20.0	3.4	47.9	14	30.9	25.3	31	10.9	73.2	45.7	29	6.0	16	73.3
Poplar River	2,030	26.13	-.15	29.93	30.61	29.18	19.143	20.2	0.8	45.0	19	29.0	18.2	31	11.2	63.2	36.7	6	7.0	1	79.0
Deadwood	4,600	25.13	-.15	29.93	30.61	29.18	19.143	20.2	0.8	45.0	19	29.0	18.2	31	11.2	63.2	36.7	6	7.0	1	79.0
Cheyenne	6,105	25.07	-.13	30.02	30.70	29.29	19.141	18.9	0.6	50.0	27	31.1	21.4	8	8.2	77.4	47.3	3	6.4	21	76.6
North Platte	2,841	26.97	-.13	30.02	30.70	29.29	19.141	18.9	0.6	50.0	27	31.1	21.4	8	8.2	77.4	47.3	3	6.4	21	76.6
Middle slope.																					
Denver	5,294	24.57	-.13	29.91	30.55	29.24	19.131	31.3	4.1	66.9	19	44.1	17.6	8	17.4	84.5	42.8	1	13.9	29	52.8
Pike's Peak	14,134	17.41	-.30	30.02	30.79	29.40	20.133	0.3	2.3	19.0	19	45.5	18.0	9	0.1	79.7	21.1	22	4.3	7	83.3
Las Animas	3,899	25.93	-.15	29.97	30.65	29.29	19.130	27.7	8.1	75.8	19	45.5	18.0	9	10.3	83.8	55.6	18	7.4	7	70.1
Concordia	1,384	27.16	-.15	29.97	30.65	29.29	19.130	27.7	8.1	75.8	19	45.5	18.0	9	10.3	83.8	55.6	18	7.4	7	70.1
Dodge City	2,523	27.34	-.11	30.04	30.75	29.45	19.030	27.1	2.0	72.9	19	41.2	17.0	9	13.8	89.9	48.7	19	10.5	16	63.8
Fort Reno	2,700	27.19	-.12	29.95	30.60	29.41	12.118	34.1	3.9	73.4	21	50.5	4.4	8	20.0	77.8	44.9	24	12.6	8	58.7
Fort Supply	2,700	27.19	-.12	29.95	30.60	29.41	12.118	34.1	3.9	73.4	21	50.5	4.4	8	20.0	77.8	44.9	24	12.6	8	58.7
Fort Elliott	2,700	27.19	-.12	29.95	30.60	29.41	12.118	34.1	3.9	73.4	21	50.5	4.4	8	20.0	77.8	44.9	24	12.6	8	58.7
Southern slope.																					
Fort Hill	1,200	28.80	-.08	30.06	30.75	29.58	12.123	37.4	2.6	75.9	16	51.2	0.2	8	24.5	75.7	41.2	24	10.9	2	49.7
Abilene	1,748	28.34	-.05	30.06	30.68	29.58	12.110	43.7	...	84.9	16	57.3	6.3	8	31.5	76.0	44.8	7	15.7	28	48.1
Fort Davis	4,928	25.18	-.05	30.02	30.61	29.75	22.086	40.2	3.0	73.0	20	60.9	16.3	1	32.8	66.7	39.4	1	14.5	6	24.1
Fort Stanton	6,150	23.89	-.09	29.87	30.40	29.52	12.084	36.0	...	64.6	15	50.1	3.8	8	22.4	60.8	47.0	19	12.9	11	57.2
Southern plateau.																					
El Paso	3,764	26.29	-.03	30.06	30.54	29.77	7.078	46.0	1.6	69.9	20	60.1	18.1	18	31.6	58.1	43.0	19	15.5	9	41.8
Lava	7,020	23.19	-.05	30.03	30.56	29.64	7.092	29.8	2.2	55.5	19	40.9	6.0	9	19.0	49.5	33.7	19	10.0	20	53.3
Santa Fe	7,020	23.19	-.05	30.03	30.56	29.64	7.092	29.8	2.2	55.5	19	40.9	6.0	9	19.0	49.5	33.7	19	10.0	20	53.3
Fort Apache	5,020	25.04	-.10	30.12	30.68	29.76	7.068	36.8	3.0	65.0	19	50.1	10.5	10	19.4	54.5	45.5	19	17.8	22	47.1
Fort Bowie	4,910	25.34	-.08	30.08	30.57	29.82	7.095	40.7	4.5	69.9	19	51.1	25.1	23	35.2	44.0	31.9	30	14.2	21	37.5
Fort Grant	4,910	25.34	-.08	30.08	30.57	29.82	7.095	40.7	4.5	69.9	19	51.1	25.1	23	35.2	44.0	31.9	30	14.2	21	37.5
Fort McDowell	2,710	27.30	-.09	30.04	30.75	29.45	19.030	27.1	2.0	72.9	19	41.2	17.0	9	13.8	89.9	48.7	19	10.5	16	63.8
Fort Thomas	2,710	27.30	-.09	30.04	30.75	29.45	19.030	27.1	2.0	72.9	19	41.2	17.0	9	13.8	89.9	48.7	19	10.5	16	63.8
Fort Verde	2,710	27.30	-.09	30.04	30.75	29.45	19.030	27.1	2.0	72.9	19	41.2	17.0	9	13.8	89.9	48.7	19	10.5	16	63.8
Maricopa	2,710	27.30	-.09	30.04	30.75	29.45	19.030	27.1	2.0	72.9	19	41.2	17.0	9	13.8	89.9	48.7	19	10.5	16	63.8
Phoenix	2,710	27.30	-.09	30.04	30.75	29.45	19.030	27.1	2.0	72.9	19	41.2	17.0	9	13.8	89.9	48.7	19	10.5	16	63.8
Prescott	5,389	24.74	-.01	30.09	30.40	29.72	7.068	37.4	2.5	68.2	2	53.6	11.2	9	23.5	51.0	42.8	26	9.2	16	54.2
San Carlos	4,928	25.18	-.05	30.02	30.61	29.75	22.086	40.2	3.0	73.0	20	60.9	16.3	1	32.8	66.7	39.4	1	14.5	6	24.1
Willcox	4,928	25.18	-.05	30.02	30.61	29.75	22.086	40.2	3.0	73.0	20	60.9	16.3	1	32.8	66.7	39.4	1	14.5	6	24.1
Yuma	141	29.94	-.00	30.06	30.33	29.74	7.039	55.6	1.8	75.5	31	68.2	30.5	11	42.4	45.0	36.7	15	13.9	20	49.6
Keeler	3,622	26.39	-.08	30.08	30.58	29.64	31.074	43.1	...	63.5	15	54.3	24.7	10	32.3	38.8	33.0	24	15.5	27	46.1
Middle plateau.																					
Fort Bidwell	4,615	25.41	-.10	30.16	30.54	29.39	19.115	32.5	...	51.6	1	41.3	6.5	55	22.5	45.1	37.2	18	9.5	23	41.3
Winnemucca	4,358	25.66	-.00	30.16	30.53	29.36	19.102	34.8	3.0	57.2	1	45.2	7.5	0	22.4	46.9	37.9	18	9.4	21	46.3
Frisco	4,358	25.68	-.00	30.16	30.51	29.34	19.098	31.9	...	51.7	1	41.4	7.0	28	22.6	47.1	39.5	17	8.9	15	55.8
Salt Lake City	4,348	25.62	-.10	30.08	30.59	29.51	19.117	31.2	4.6	51.5	19	40.9	1.8	9	25.3	39.6	27.7	29	9.2	37.1	1
Montrose	5,780	24.26	-.05	30.06	30.66	29.49	19.117	27.5	...	59.5	19	39.4	1.8	9	14.7	57.7	41.5	19	11.0	6	67.6

Meteorological record of voluntary observers and Army post surgeons, January, 1887.

The maximum and minimum temperatures marked thus (*) are from readings of other than standard instruments.

Stations.	Temperature.				Stations.	Temperature.			
	Maximum.	Minimum.	Mean.	Rainfall.		Maximum.	Minimum.	Mean.	Rainfall.
Alabama.					Iowa.				
Greensborough.....	72	12	45.0	3.32	Bancroft.....	35	-27	2.0	0.97
Livingston.....	76	10	45.0	3.32	Cedar Rapids.....	40	-24	13.5	2.00
Mount Vernon B'ks.	75	14	48.1	4.49	Cedar Rapids.....	40	-32	8.8	
Arizona.					Cresco.....	33	-32	3.0	0.73
Lowell.....	82	18	49.5	0.00	Des Moines.....	50	-34	9.8	
McDowell.....	79	18	49.4	0.00	Humboldt.....	42	-28	5.2	
Arkansas.					Independence.....	38	-25	7.9	1.25
Lead Hill.....	75	-7	34.3	1.33	Logan.....	40	-26	10.9	0.90
California.					Madison, Fort.....	54	-21		
Anderson.....	76	28	49.3	1.41	Monticello.....	43	-32	8.9	2.39
Alcatraz Island.....	66	41	50.7	1.40	Mount Vernon.....	45	-26	9.0	
Angel Island.....	75	36	51.9	1.96	Muscatoine.....	45	-30	12.5	1.88
Benicia Barracks.....	66	36	49.7	1.12	Oskaloosa.....	40	-27	10.3	0.96
Bidwell, Fort.....	53	8	34.1	2.57	Oskaloosa.....	42	-24		
Cahuenga Valley.....					Kansas.				
College City.....	70	30	50.0	0.46	Allison.....	62	-23	26.2	0.20
Gaston, Fort.....					Belleville.....	54	-10	26.4	
Mason, Fort.....	64	41	51.7	0.86	Blue Rapids.....	53	-18	21.8	0.85
Nicolans.....	71	30	48.3	1.12	El Dorado.....	69	-21	26.7	0.28
Oakland.....	66	35	49.4	1.57	Globe.....	60	-24	22.6	0.91
Oroville.....	70	32	50.8	1.02	Hays, Fort.....	75	-28	23.0	0.40
Presidio of San F.....	68	37	51.2	1.26	Independence.....	68	-18	27.1	0.79
Princeton.....	69	22	48.7	0.47	Manhattan.....	55	-24	19.6	0.30
Riverside.....	78	26	51.4	0.13	Manhattan.....	62	-23	22.2	0.68
Sacramento.....	65	26	44.3	1.07	Minnescah.....	72	-20	26.0	
Salinas.....	70	26	46.8	0.75	Ottawa.....	67	-22	21.7	0.41
Santa Barbara.....	79	37	54.7	0.31	Riley, Fort.....	58	-25	21.7	0.14
Santa Maria.....	80	30	54.0	0.50	Salina.....	45	-11	26.0	0.02
Colorado.					Wakefield.....	64	-16	27.7	0.39
Collins, Fort.....	79	-13	26.9	0.86	Wellington.....	63	-20	26.7	0.48
Lewis, Fort.....	47	-5	24.5	0.15	West Leavenworth.....	54	-6		
Connecticut.					Wyandotte.....	59	-20	21.4	0.02
Bethel.....	-12			4.54	Kentucky.				
North Colebrook.....	49	-16	18.1	2.86	Richmond.....	67	-5	31.5	4.30
Voluntown.....	60	-5		7.00	Louisiana.				
Dakota.					Grand Coteau.....	75	17	50.3	2.57
Abr. Lincoln, Fort.....	36	-48	-8.6	1.18	Liberty Hill.....				2.52
Henry.....	49	-33	17.4	0.23	Maine.				
Meade, Fort.....	42	-45	-13.1	1.56	Cornish.....	48	-17	16.3	4.34
Pembina, Fort.....	51	-33	10.0	0.24	Gardiner.....	45	-23	15.8	7.32
Richardson.....	32	-38	-2.7	2.00	Kent's Hill.....	43	-19	12.8	3.86
Sisseton, Fort.....	32	-40	-5.0	0.40	Orono.....	44	29	14.0	7.56
Sully, Fort.....	40	-30	3.0	0.25	Maryland.				
Totten, Fort.....	32	-31	-9.9	0.91	Cumberland.....	60	-6	28.6	0.30
Webster.....	34	-44	-12.6	4.55	Fallston.....	58	-1	28.6	2.72
Yates, Fort.....	29	-50	-2.4	0.86	Great Falls.....	60	2	31.9	2.19
District of Columbia.					McDonogh.....	62	2	30.2	2.72
Distributing reservoir.....	66	7	32.7	3.80	McHenry, Fort.....	53	8	31.1	0.93
Receiving reservoir.....	64	4	32.2	3.41	New Midway.....	66	-2	32.0	2.02
Rock Creek.....	68	9	35.9		Woodstock.....	63	1	30.0	0.49
Florida.					Massachusetts.				
Archer.....	71	23	48.9	3.52	Amherst.....	47	-22	19.4	4.57
Alva.....	84	31	57.9	1.10	Amherst.....	48	-12	21.9	4.83
Duke.....	75	25	51.4	1.25	Blue Hill Obs'y.....	52	-11	21.3	5.19
Meade, Fort.....	82	27		1.26	Deerfield.....	50	-24	19.5	4.187
Limona.....	82	38	57.5	2.07	Dudley.....	50	-11	23.0	3.50
Manatee.....	84	31	58.1	2.40	Fall River.....	55	3	25.7	7.38
Merritt's Island.....	80	35	58.6	2.43	Heath.....	56	-12		
Tallahassee.....	76	21		6.20	Milton.....	59	-13	26.1	4.54
Georgia.					New Bedford.....	52	-5	26.7	5.99
Forsyth.....	72	14	43.5	3.95	North Truro.....				4.14
Milledgeville.....	73	12	41.0	3.73	Somerset.....	59	-8	26.5	6.08
Quitman.....	74	19	47.1	3.50	Taunton.....	58	-7	25.1	7.33
Idaho.					Westborough.....	56	-22	27.1	4.85
Boise Barracks.....	52	14	36.0	2.42	Williamstown.....	57	-17	20.0	6.29
Coeur d'Alene, Fort.....	46	13	32.5	4.08	Worcester.....	49	-7	21.1	5.21
Lewiston.....	60	39		2.87	Michigan.				
Illinois.					Birmingham.....	49	-17		1.54
Bloomington.....	55	-18			Brady, Fort.....	34	-29	6.4	1.63
Collinsville.....	60	-18	23.9	0.60	East Saginaw.....	45	-13	19.5	4.89
Charleston.....	62	-20	23.0	1.02	Harrisville.....	45	-17		
Jacksonville.....	62	-30	19.9	0.89	Hudson.....	52	-23		1.05
Mattoon.....	63	-21	24.0	1.30	Kalamazoo.....	45	9	27.0	2.25
Pekin.....	53	-27	17.0	2.16	Lansing.....	48	-20	18.3	3.36
Peoria.....	50	-21	21.0	1.10	Mottville.....	55	-26		1.63
Riley.....	42	-25	11.1	3.59	Swartz Creek.....	53	-25	17.3	2.62
Rockford.....	40	-30	12.7	4.21	Thornville.....	52	-22	19.2	2.30
Sandwich.....	46	-26	15.2	4.56	Traverse City.....	39	15		4.66
South Evanston.....	46	-22		4.05	Minnesota.				
Sycamore.....	43	-24	12.5	1.93	Minneapolis.....	38	-34	0.2	1.37
Windsor.....	60	-19	21.8	3.49	Snelling, Fort.....	32	-42	-1.1	0.80
Indian Territory.					Missouri.				
Gibson, Fort.....	73	-19	34.9	0.41	Central College.....	60	-16		1.10
Reno, Fort.....	73	9	34.8	0.00	Centerville.....	66	-15		1.98
Supply, Fort.....	75	-23	30.4	0.00	Conception.....	47	-24	11.9	
Indiana.					Springfield.....	50	-11	34.5	2.60
Butlerville.....	66	-13	24.0	3.38	Montana.				
Fort Wayne.....	60	-12	24.0	1.29	Keogh, Fort.....	49	-50	8.6	1.20
Jeffersonville.....	62	5	31.6	3.73	Missoula, Fort.....	42	-9	25.6	1.20
Laconia.....	63	0	29.0	3.60	Shaw, Fort.....	49	-34	18.6	
Lafayette.....	62	-13	20.1	1.18	Nebraska.				
La Grange.....	54	-16	19.0	0.89	Brownville.....	50	20	16.8	0.90
Logansport.....	64	-27	22.4	2.85	Crete.....	63	-23	10.8	0.33
Mauzy.....	60	-17	21.2	2.02	De Soto.....	56	-20	29.8	0.30
Sumner.....	60	-13	26.1	3.13	Fairbury.....	50	-22		0.79
Vevay.....	64	-7	30.4	4.18	Frederick.....	46	-27	10.9	1.03
					Hay Springs.....	50	-23	17.1	0.81

Meteorological record of voluntary observers, etc.—Continued.

Temperature.					Temperature.				
Stations.	Maximum.	Minimum.	Mean.	Rainfall.	Stations.	Maximum.	Minimum.	Mean.	Rainfall.
Nebraska—Cont'd.					Oregon.				
Lincoln.....	55	-22	14.7	0.15	Albany.....	50	30	43.8	12.58
Marquette.....				0.15	East Portland.....	47	30		
Niobrara, Fort.....	51	-30	14.6	1.00	Eola.....	54	25	41.0	9.86
Robinson, Fort.....	54	-25	21.3	1.11	Klamath, Fort.....	54	-1	39.7	4.44
Sidney, Fort.....	61	-17	23.4	0.12	La Grande.....	45	14		5.18
Stockham.....				0.25	Mount Angel.....	64	27	43.0	15.36
Tecumseh.....	49	-18	17.8	0.75	Pennsylvania.				
Yutan.....	46	-22	11.3	0.35	Altoona.....	62	1	33.1	0.52
Nevada.					Bloomington.....	52	-14		3.50
Carson City.....	61	8	36.5	1.10	Catawissa.....	58	3	24.4	2.68
McDermitt, Fort.....	49	9	31.1	0.52	Dyberry.....	49	-18	19.8	4.00
New Hampshire.					Easton.....				5.01
Antrim.....	43	-20		5.82	Fallsington.....	61	3	27.3	2.92
Ashland.....				4.23	Franklin.....	44	-12	21.1	2.65
Belmont.....				4.19	Grampian Hills.....	54	-12	22.1	3.57
Berlin Mills.....	56	-33			Meadville.....	59	-5	25.0	
Bristol.....				3.66	Phillipsburg.....	59	-12	21.8	6.50
Lake Village.....				3.56	Quakertown.....	55	1	27.6	3.88
Nashua.....	53	-25	19.9	5.43	State College.....	58	-7	21.6	0.98
Wier's Bridge.....				3.58	Wellsborough.....	45	-14	24.2	4.40
Woolborough.....				5.19	West Chester.....	62	3	26.1	3.95
Woodstock.....				6.90	Wysox.....	57	-10	23.5	0.66
New Jersey.					Zionsville.....	54	5	33.4	5.58
Beverly.....	63	40	38.9	2.30	South Carolina.				
Clayton.....	67	5	29.1	2.79	Aiken.....	72	16	43.9	4.48
Dover.....	56	4	24.7	6.21	Kirkwood.....	67	12	39.8	3.13
Lakewood.....	67	8	37.5		Pacolet.....	66	8	30.5	1.94
Moorestown.....	65	2	28.4	2.92	Spartanburg.....	46	31	17.3	2.33
Paterson.....	60	4	28.8	3.96	Stateburg.....	71	12	42.4	3.30
Readington.....	68	6	31.6		Tennessee.				
Roseland.....	58	-4		4.84	Ashwood.....	68	3	35.5	4.41
Salem.....	63	4	32.2		Austin.....	71	2	38.8	3.73
South Orange.....	60	8	28.7	3.50	Milan.....	70	1	37.3	4.92
Upper Montclair.....	53			2.96	Texas.				
New Mexico.					Austin.....	81	17	48.8	0.28
Bayard, Fort.....	76	17	43.9	0.08	Cleburne.....	82	0	38.0	0.43
Gallinas Spring.....	59	3		0.75	Comfort.....				0.00
Selden, Fort.....	73	11	43.1	0.10	Corsicana.....				0.14
Union, Fort.....	69	-10	32.2	0.45	Dallas.....	80	6	47.2	
Wingate, Fort.....	51	3	31.4	0.52	McIntosh, Fort.....	84	18	53.4	trace.
New York.					Midland.....	79	7	41.7	0.09
Auburn.....	53	-2	23.1	3.05	New Ulm.....	81	16	49.6	1.09
Brooklyn.....	61	5	31.3	2.46	Ringold, Fort.....	93	23	58.4	trace.
Columbus, Fort.....	56	5	28.7	4.53	Silver Falls.....	78	-5		trace.
Cooperstown.....	51	-18	18.0	3.23	Vermont.				
Factoryville.....	55	-12	22.7	1.20	Brattleborough.....	46	-22	18.5	6.58
Humphrey.....	52	5	20.1	4.06	Burlington.....	49	-17	18.1	1.87
Ithaca.....	56	-12	22.9	1.55	Charlotte.....	50	-17	14.2	2.49
Le Roy.....	56	8	21.2	2.52	Lunenburg.....	49	-25	13.3	3.00
Madison Barracks.....	50	-36	14.7	2.86	Newport.....	41	-36	11.3	5.88
Menand.....	46	-14	19.6	2.97	Post Mills.....	44	-42	8.2	1.10
Niagara, Fort.....	48	-4	23.0	0.64	Poultney.....	44	-26	15.5	3.97
North Volney.....	49	-14	19.0		Stratford.....	42	-24	12.9	5.59
Palermo.....	44	-18	17.0	5.39	Virginia.				
Palmyra.....	47	-7			Bird's Nest.....	70	13	38.9	2.70
Penn Yan.....				0.97	Brington.....	65	10		2.89
Setauket.....	57	4	29.2	5.33	Dale Enterprise.....	63	0	33.6	3.42
Utica.....	47	-20			Marion.....	66	3	32.5	2.88
West Point.....	52	-7	24.5	4.40	Monroe, Fort.....	65	12	38.3	3.27
White Plains.....	50	-4	26.2	4.38	Rappahannock.....	69	-2	30.7	2.34
North Carolina.					Snowville.....	65	2		2.50
Chapel Hill.....	72	8	39.1	2.81	Summit.....	68	2	32.1	
Flat Rock.....	61	3	33.3	4.38	University of Va.....	61	17	39.0	1.79
Lenoir.....	62	3		4.60	Variety Mills.....	65	1	32.9	2.16
Lincolnton.....	63	1	32.7	2.35	Wytheville.....	63	6	33.5	
Raleigh.....	74	6	41.0	2.65	Washington Territory.				
Reidsville.....	78	1	28.2		Bainbridge Island.....	52	30	42.5	3.51
Statesville.....	65	6	35.7	2.36	Kenewick.....	58	14		0.18
Wake Forest.....	71	7	39.8	3.01	Spokane, Fort.....	52	3	29.3	0.16
Weldon.....	70	10	38.8	3.47	Tacoma.....	50	25	39.8	5.81
Ohio.					Townsend, Fort.....	54	15	41.2	3.80
Cleveland.....	62	-6	25.7	2.24	Walla Walla, Fort.....	56	21	41.5	
Colge Hill.....	70	-16	34.2	3.00	West Virginia.				
Elyria.....	62	-15	32.7	2.38	Clarksburg.....	61	-8	29.4	1.63
Garrettsville.....	61	-18	22.5	1.73	Holletia.....	68	-6	31.0	3.75
Hiram.....	62	-8	22.9	1.83	Middlebrook.....	58	6	25.6	
Jacksonborough.....	60	-12	24.6	1.85	Parkersburg.....	66	-3	30.9	1.54
Napoleon.....	60	-11	24.2	1.85	Wisconsin.				
North Lewisburg.....	64	-10	23.2	3.05	Delavan.....	40	-27	11.6	4.05
Portsmouth.....	65	4	33.0	2.84	Embarras.....	44	-30	2.0	2.05
Ruggles.....	56	-8	23.2	1.90	Fond du Lac.....	41	-42	8.9	1.26
Tiffin.....	59	8	23.7	1.75	Madison.....	39	-29	10.0	3.09
Tiffin.....	66	-11	31.2	1.67	Manitowoc.....	37	-18	13.8	1.62
Wauseon.....	59	-20	19.3	2.36	Wausau.....	35	-36	5.0	1.54
Weserville.....	62	-10	27.4	1.81	Wyoming.				
West Milton.....	65	-13	26.7	3.50	Camp Sheridan.....	40	-21	18.3	7.70
Yellow Springs.....	60	-9	26.2	2.40	Laramie, Fort.....	59	-14	24.4	0.39
					Washakie, Fort.....	47	-25	22.0	0.43

Rynd Farm, Venango county, Pennsylvania: on the 24th an ice gorge, two miles long, formed in Oil Creek, causing the water to rise rapidly and submerge all the low land in the vicinity.

Machias, Washington county, Maine: on the 28th and 29th very heavy rain fell, melting the snow that covered the ground to a depth of twenty inches, and causing an extensive flood.

Portland, Oregon: the total rainfall of this station for the month was 12.31 inches; on the 23d 2.50 inches fell in sixteen hours. From 10 a. m. to 4 p. m. of that date the rainfall was unusually heavy, causing Tanner Creek, a small stream flowing through the western portion of the city, to overflow its banks and carry away wooden sidewalks, fences, and numerous small shanties occupied by Chinese; one person was drowned.

ATMOSPHERIC ELECTRICITY.

AUROSAS.

Saint Vincent, Minnesota: at 9.50 p. m. of the 18th an auroral light was observed faintly tinging the northern sky. As the night advanced the display increased in magnitude and brilliancy, illuminating at midnight the whole of the northern sky; at times broad, reddish colored streamers would ascend rapidly toward the zenith. The light was most brilliant at 12.18 a. m. of the 19th, after which it began to fade. The observer at this place states that at 11.20 p. m. of the 24th the indications of an electrical disturbance were manifested by a humming noise made by the telegraph wire running into the office and the imperfect working of the telegraph instruments. Shortly after, an auroral light became visible above the northern horizon; the display increased in magnitude and assumed the form of a bright red arch resting upon a dark base, altitude 15°. The aurora remained in this position until 12.10 a. m. of the 25th, when a second arch began forming under the first; at about 1 a. m. the two arches blended into a diffuse pink light. The display ended at 2 a. m.

Lyons, Wayne county, New York: a diffuse auroral light was visible between 10 p. m. and midnight of the 22d.

Auroral displays were also observed at the following places:

- 7th.—Albany, New York.
- 14th and 15th.—Dudley, Massachusetts; Escanaba, Michigan.
- 16th.—Fort Totten, Dakota; Gardiner, Maine; Wellsborough, Pennsylvania.
- 17th.—Fort Totten, Dakota.
- 18th.—Kent's Hill and Gardiner, Maine.
- 20th.—Wellsborough, Pennsylvania.
- 22d.—Fort Buford and Webster, Dakota; Duluth and Moorhead, Minnesota.
- 23d.—Bismarek, Dakota.
- 24th.—Pekin, Illinois.
- 25th.—Fort Totten and Fort Buford, Dakota.
- 26th and 29th.—Pekin, Illinois.

THUNDER-STORMS.

Thunder-storms are reported to have occurred in the various states and territories during the month, as follows:

- Alabama.—Montgomery, 13th, 23d; Livingston, 13th, 29th; Mobile, 23d.
- Arkansas.—Little Rock and Lead Hill, 22d.
- Florida.—Merritt's, Island, 1st, 13th, 14th; Key West, 7th; Limona, 13th; Archer, 13th, 14th, 23d; Duke and Sanford, 14th; Cedar Keys and Pensacola, 23d.
- Georgia.—Quitman, 12th, 14th, 23d; Savannah, 13th; Mill-edgeville, 13th, 23d; Atlanta and Forsyth, 23d.
- Illinois.—Chicago, Collinsville, Manhattan, Pekin, and Peoria, 22d.
- Indiana.—Butlerville, Laconia, Sunman, and Vevay, 13th.
- Iowa.—Dubuque, Monticello, and Cedar Rapids a, 21st, 22d; Cedar Rapids b, Fort Madison, Independence, and Oskaloosa, 22d.
- Kansas.—Allison, 19th; Independence and Wellington, 22d.
- Kentucky.—Louisville, 13th.
- Louisiana.—Grand Coteau, 22d, 23d, 28th, 29th; Shreveport, 22d, 28th; New Orleans, 23d.

Massachusetts.—Blue Hill Observatory, Cambridge, and Milton, 24th; Fall River, 26th.

Michigan.—Kalamazoo and Mottville, 22d.

Minnesota.—Saint Vincent, 10th.

Mississippi.—Vicksburg, 22d, 23d, 28th.

Missouri.—Centreville, Central College, and Conception, 22d.

North Carolina.—Kitty Hawk and Hatteras, 13th; Smithville and West Point, 14th; Flat Rock, 23d.

Ohio.—College Hill, Jacksonborough, West Milton, and Yellow Springs, 13th.

Oregon.—Mount Angel, 15th.

South Carolina.—Charleston, 13th, 29th; Spartanburg, 23d.

Tennessee.—Austin and Chattanooga, 13th; Milan, 13th, 22d, 28th; Nashville, 13th, 23d; Knoxville, 23d, 24th; Ashwood, 13th, 28th.

Texas.—Cleburne, Dallas, and New Ulm, 22d.

Wisconsin.—Delavan, Fond du Lac, Madison, and Manitowoc, 21st.

ELECTROMETER READINGS.

Observations of the electrical potential of the atmosphere have been continued during the month of January, 1887, as usual. At Washington City, in a series of simultaneous observations at the top of the Washington Monument and at the Signal Office on January 28th, the following values were obtained:

Time.	Monument.	Signal Office.	Difference.	Time.	Monument.	Signal Office.	Difference.	Remarks.
	Volts.	Volts.	Volts.		Volts.	Volts.	Volts.	
1 p. m.	375	162	213	2 p. m.	450	150	300	Wind, wsw.; sky about nine-tenths covered with cirro-stratus clouds. At the Monument, wind blowing strongly on the collector. A very feeble spark could be obtained after 2 p. m. on "grounding" the needle.
1.05 p. m.	325	144	81	2.05 p. m.	500	138	362	
1.10 p. m.	300	132	168	2.10 p. m.	500	144	456	
1.15 p. m.	300	126	174	2.15 p. m.	500	126	374	
1.20 p. m.	350	126	124	2.20 p. m.	375	132	243	
1.25 p. m.	300	132	168	2.25 p. m.	325	96	229	
1.30 p. m.	425	138	287	2.30 p. m.	450	96	354	
1.35 p. m.	250	132	118	2.35 p. m.	500	102	398	
1.40 p. m.	375	138	237	2.40 p. m.	500	120	380	
1.45 p. m.	425	132	293	2.45 p. m.	500	152	348	
1.50 p. m.	375	156	219	2.50 p. m.	500	180	320	
1.55 p. m.	375	156	219	2.55 p. m.	500	186	314	
				3 p. m.	500	192	308	

In the regular series of observations, negative values were obtained at 9 and 11 a. m. on the 10th, during clear weather with brisk northwesterly winds, and do not appear to be reconcilable with any noted change in the weather; on the 17th, preceding and during rain; on the 24th, during rain and during the commencement of snow; on the 26th, small values, during light rain; and on the 29th, during rain. Snow was generally accompanied by positive values.

At Baltimore, Maryland, a continuous photographic record has been obtained, and the following notes are abstracted from the observer's report: "There have been, during the month, four electrical storms. The first began with a rapidly increasing positive potential at 7 p. m. on December 31st, which became normal at 9 a. m. of January 1st. Fluctuations, rapidly alternating in sign, and in magnitude far beyond 1,000 volts, occurred until 12.30 a. m., followed by smaller oscillations until 3.30 a. m., from which time until 6.30 a. m. the curve is normal. A sudden fall to a negative value of 900 volts then occurs, and the potential remains negative until 9 a. m. Snow began at 1.30 p. m. on December 30th, changing to rain, which ended at 9.15 a. m. January 1st. The second disturbance began, with a sharply falling potential, at 7 p. m. on January 13th, and ended at 5.30 a. m. of the 14th. The most violent fluctuations occurred from midnight until 1.30 a. m. Rain began at 6.55 p. m. on the 13th and ended on the a. m. of the 14th. The third period of disturbance was preceded by a slowly falling potential from noon of the 16th until noon of the 17th, when occurred a sudden drop to a negative value of 800 volts, followed by slow fluctuations until 5 p. m., when the curve became normal. Rain began at 10.55 a. m. and ended at 4.10 p. m. of the 17th instant. The fourth, a storm of great violence,

continued from 3 a. m. to 3 p. m. of the 24th. At the former time the potential suddenly rose to a very high value, and remained beyond the scale limit until 5 a. m., when it rapidly fell to 700 volts negative. Oscillations from positive to negative continue until 1.20 p. m., when the potential becomes positive, reaching an observed value of 2,500 volts, becoming normal at 3 p. m. Rain began on the morning of the 24th, turning to snow at 11.45 a. m. and ending at 2.50 p. m."

At New Haven, Connecticut, negative values were obtained on December 31st, during sleet; on January 1st, during rain; on the 14th, during rain; on the 17th, during rain; on the 24th, during rain; on the 29th, during rain. Snow was accompanied by characteristic positive values on the 4th, 5th, 15th, and 26th.

At Boston, Massachusetts, negative values were recorded on January 4th, in advance of, and during, snow; at 1 p. m. on the 5th, six hours in advance of rain; on January 9th, preceding, and during, snow; on January 24th, during rain, preceding thunder by two hours; on the 26th, at 9 and 11 a. m., preceding snow, beginning at 11.15 a. m. Thus on all these dates the electrometer indications might have been successfully used in the prediction of coming weather changes. Rain occurred on December 31st and January 1st, ending at 2.10 p. m. of the latter date, accompanied with low positive values. High positive values prevailed during the clear weather following. Rain on the 6th from 11 a. m. until 1 p. m., preceded by snow, was accompanied by low positive values. Snow and rain on the 14th and 17th were accompanied by low positive values. On the 24th rain began at 7 a. m., ending at 8.45 a. m., beginning again at 9.05 and continuing throughout the day. Two loud peals of thunder were heard at 1.30 p. m. The values noted for the four observations were, respectively, 14.0, -31.6, 20.2, and 30.8 volts. On the 28th light drizzling rain began at 12.30 p. m. and continued until 2.15 p. m. A negative value was observed at 10 a. m., or two and a half hours in advance of the commencement of the rain. Snow, as was said above, in several cases was preceded, sufficiently long to be of value in prediction of the weather, by negative values, and in all cases by a fall in the value of the potential. At Columbus, Ohio, negative values were recorded only on the 14th, with threatening weather and rain, and on the 28th, during fine rain. Snow at this station was generally accompanied by positive values.

At Ithaca, New York, snow on January 1st, 5th, and 7th, was accompanied by positive values. On January 10th light snow began at 8.45 a. m., ending at 10 a. m. The values at the 9 and 11 a. m. observations being, respectively, negative 130 volts, and positive 40 volts. On January 13th negative values precede the snow by five hours; on the 15th, during the continuance of snow all that day and the next, the values remain negative, when, as a rule, during continued snow, values which are at first negative change to positive, often of very high value. On the 17th negative indications precede rain four hours. Snow on the 18th is accompanied by high positive values. On the 19th and 20th, during cloudy weather, negative values are recorded, from which snow might have been anticipated on either date. Snow on the 21st was accompanied by negative, and preceded by low positive values. On the 24th negative values were obtained during snow; on the 26th, low, changing to high positive values, were recorded during snow; and on the 28th negative values were obtained during threatening weather.

Chart vi shows the observations made at the different stations during the month of January.

There would seem to be at all four stations some slight agreement as to the dates of negative values, particularly on January 24th.

As the observations at present embrace but a part of the days, and are made at different elevations, and under differing conditions, it is hardly worth while to do more, in the discussion of these results at present, than to call attention to some of the most general correspondences.

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos were observed in the various states and territories on the following dates:

Arizona.—4th, 19th, 20th, 26th, 27th.
California.—1st, 2d, 4th, 19th, 27th.
Colorado.—7th.
Connecticut.—7th, 8th, 13th, 19th.
Dakota.—1st, 5th, 6th, 7th, 9th, 16th, 31st.
District of Columbia.—7th, 9th, 10th.
Florida.—14th, 28th.
Georgia.—4th, 19th, 28th.
Idaho.—9th.
Illinois.—1st to 3d, 5th to 11th, 13th, 16th, 18th, 21st, 24th, 27th to 30th.
Indiana.—6th, 11th, 12th, 22d, 24th.
Iowa.—1st, 2d, 3d, 5th, 6th, 7th, 10th, 12th, 17th, 18th, 25th, 30th.
Kansas.—6th, 18th, 19th, 21st, 25th, 26th, 27th, 29th, 30th, 31st.
Maine.—9th, 12th, 13th, 19th, 31st.
Maryland.—7th, 9th, 10th, 13th, 19th, 20th.
Massachusetts.—7th to 10th, 13th, 17th, 19th, 23d, 25th, 31st.
Michigan.—6th, 11th, 13th, 20th, 27th, 29th, 30th.
Minnesota.—4th, 10th, 17th, 20th, 21st, 22d, 25th, 30th.
Missouri.—1st.
Montana.—10th, 14th, 17th.
Nebraska.—1st, 3d, 6th, 31st.
Nevada.—2d.
New Hampshire.—8th, 13th, 19th, 25th, 28th, 31st.
New Jersey.—7th, 8th, 19th, 28th.
New York.—4th, 5th, 7th, 8th, 13th, 20th, 25th, 27th, 30th.
North Carolina.—3d.
Ohio.—4th, 6th, 7th, 8th, 11th, 16th, 21st, 26th.
Oregon.—16th.
Pennsylvania.—4th, 7th, 8th, 14th, 25th, 31st.
South Carolina.—2d, 4th, 6th, 13th, 19th, 28th.
Tennessee.—2d, 3d, 4th, 6th, 7th, 14th, 16th, 19th, 21st, 23d, 27th, 30th.
Vermont.—13th.
Virginia.—4th, 7th, 9th, 10th, 31st.
Wisconsin.—1st, 3d, 5th, 6th, 7th, 9th, 10th, 14th, 17th, 18th, 21st, 25th, 27th, 29th.

LUNAR HALOS.

Lunar halos were observed in the various states and territories during the month, as follows:

Arizona.—1st to 5th, 12th, 30th.
Arkansas.—5th, 6th, 30th.
California.—1st to 6th, 11th, 29th.
Colorado.—2d to 5th, 7th, 8th, 15th.
Connecticut.—6th, 7th, 8th, 11th, 31st.
Dakota.—1st, 3d to 8th, 10th, 11th, 15th, 16th, 29th, 30th, 31st.
Delaware.—11th.
District of Columbia.—7th.
Florida.—6th, 10th, 31st.
Georgia.—4th, 6th, 30th.
Illinois.—1st, 3d, 4th, 5th, 7th to 12th, 29th, 30th.
Indiana.—3d, 5th, 7th, 10th, 11th, 27th, 29th, 30th.
Iowa.—3d, 5th, 11th, 16th, 17th, 29th, 31st.
Kansas.—1st, 3d, 5th, 6th, 7th, 10th, 14th, 18th, 19th, 21st, 29th, 30th, 31st.
Kentucky.—3d.
Louisiana.—1st, 3d, 8th, 29th.
Maine.—7th, 8th, 31st.
Maryland.—4th, 6th, 7th.
Massachusetts.—4th, 6th, 7th, 8th, 11th.
Michigan.—2d, 3d, 4th, 7th to 10th, 13th, 18th, 19th, 29th.
Minnesota.—2d, 3d, 5th, 8th, 10th, 11th, 20th, 31st.
Missouri.—5th, 7th, 12th, 30th, 31st.
Montana.—3d, 5th, 9th, 10th.

Nebraska.—2d, 4th, 5th, 6th, 9th, 10th, 11th, 13th, 17th, 29th, 30th.

Nevada.—4th.

New Hampshire.—1st, 6th, 7th, 8th, 11th.

New Jersey.—4th, 6th, 7th, 8th, 11th, 13th, 31st.

New Mexico.—4th.

New York.—4th to 8th, 10th, 11th.

North Carolina.—2d, 4th, 6th, 8th.

Ohio.—1st to 6th, 8th, 10th to 13th, 16th, 27th to 31st.

Oregon.—1st to 5th, 8th, 10th, 14th.

Pennsylvania.—4th, 5th, 7th, 8th, 11th, 12th, 13th, 16th, 20th, 25th.

Rhode Island.—7th, 8th, 11th.

South Carolina.—2d to 7th, 28th, 30th.

Tennessee.—2d to 7th.

Texas.—2d to 6th, 8th.

Utah.—2d.

Vermont.—4th, 6th, 7th, 8th, 11th.

Virginia.—4th, 6th, 7th, 8th, 10th, 11th, 14th, 21st, 31st.

Washington Territory.—7th, 16th.

West Virginia.—4th, 6th.

Wisconsin.—4th to 12th, 27th, 29th, 30th.

The phases of the moon (Washington mean time) during January, as given in "The American Ephemeris and Nautical Almanac" for 1887, are as follows: New moon, 23d, 9 h. 52.9 m.; first quarter, 1st, 19 h. 12.3 m., and 31st, 15 h. 18.6 m.; full moon, 9th, 5 h. 24.0 m.; last quarter, 15th, 22 h. 13.8 m.; perigee, 11th, 12.9 h.; apogee, 27th, 13.6 h.

MIRAGE.

Mirages were observed during the month at the following places:

Dakota.—Henry and Webster, 27th.

Kansas.—Belleville, 9th; Salina, 15th, 17th, 18th, 24th, 29th.

Nebraska.—Marquette, 9th, 10th, 12th, 13th, 19th, 20th, 21st, 26th; Genoa, 9th.

Arizona.—Willcox, mirage seen nearly every day of the month.

MISCELLANEOUS PHENOMENA.

FOREST AND PRAIRIE FIRES.

Taylor, Williamson county, Texas: on the afternoon of the 14th a large area of prairie land, a few miles north of this place, was burned over. Five thousand sheep were surrounded by the fire; five hundred were killed and a large number injured.

Tablequah, Indian Territory: a disastrous prairie fire occurred two miles north of this place on the afternoon of the 19th. The wind was blowing a gale at the time, causing the fire to spread rapidly and burn everything in its path; fences, hay, and out-buildings were destroyed, as well as many acres of prairie grass.

Eureka Springs, Carroll county, Arkansas: on the 18th, 19th, and 20th extensive forest fires were burning near this town. On the 20th the fire spread to the outskirts of the town and consumed two frame dwellings.

Forest and prairie fires were also reported from the following places:

Fort Reno, Indian Territory: prairie fires, 11th, 12th, 15th, 19th, 29th.

Fort Supply, Indian Territory: prairie fires, 19th, 20th, 21st, 27th, 28th.

Fort Sill, Indian Territory: prairie fire, 19th.

Silver Falls, Texas: prairie fires, 14th, 25th to 29th.

Duke, Florida: forest fire, 18th.

METEORS.

Oroville, Butte county, California: on the 2d, at 8 p. m., a meteor, of greenish color, started from a point about 30° west of the zenith and moved westward; as it progressed the color changed to red, and the meteor burst with a loud report.

Rockport, Essex county, Massachusetts: at 5.15 p. m. of the 3d a large and brilliant meteor passed over this town, moving from west to east; it was visible fully one minute. This meteor was also seen by the keeper of the breakwater light-

house at Block Island, Rhode Island, who states that it was visible about one minute and disappeared seaward. The observer at Eastport, Maine, states that at 5.15 p. m. of the 3d a large meteor passed over that station from southwest to northeast, and was remarkable not only for its brilliancy but for the length of time that it was visible, about fifty seconds.

Riverside, San Bernardino county, California: Mr. A. K. Holt, voluntary observer at this place, furnishes the following descriptions of meteors observed by him during the month: "At exactly 7 o'clock (standard time), January 10th, a very bright meteor, like an immense ball of metal at white heat, appeared in the southeast about 10° above the horizon, moving from the north. In a few moments it exploded, scattering fire in every direction. The meteor was so bright that it cast a very clearly defined shadow, dimming the light of the full moon that was shining brightly at the time. On the evening of January 20th, at 7.32 (standard time), an extraordinarily bright meteor passed over from south to north, near the zenith, followed by a white trail thirty-five to forty degrees in length, giving the phenomenon the appearance of an immense bar of molten iron traversing the sky, the head of which continually threw off corruscations of fire." Reports of this meteor have been received from points one hundred and twenty-five miles south and sixty miles north of Riverside.

Cape Henlopen, Delaware: a brilliant meteor, about the size of an orange, and followed by a long train, was observed at 10 p. m. of the 23d, moving from north to south.

Meteors were also reported from the various stations, as follows:

Arizona.—Yuma, 10th.

Indiana.—Logansport, 10th; Butlerville, 20th; Vevay, 29th.

Iowa.—Monticello, 5th, 14th.

Kansas.—Wakefield, 4th; Salina, 4th, 28th, 29th; Wyandotte, 26th; El Dorado, 30th.

Massachusetts.—Dudley, 1st; Fall River, 3d.

Nebraska.—Fremont, 30th.

New Hampshire.—Berlin Mills, 3d.

New Jersey.—Beverly, 10th; Dover, 21st; Clayton, 31st.

Ohio.—Jacksonborough, 27th.

Oregon.—Linkville, 2d; Lakeview, 17th.

South Carolina.—Stateburg, 24th, 25th.

Texas.—Cleburne, 15th.

Virginia.—Rappahannock, 11th.

West Virginia.—Middlebrook, 26th.

MIGRATION OF BIRDS.

Geese flying southward.—Fort Reno, Indian Territory, 7th; Ashwood, Tennessee, 8th; Tatoosh Island, Washington Territory, 9th; Linkville, Oregon, 16th.

Geese flying northward.—Austin, Tennessee, and Marion, Virginia, 2d; Chattanooga, Tennessee, 8th; Salina, Kansas, and Fort Reno, Indian Territory, 15th; Stockham, Nebraska, 21st, 24th; Fort Madison, Iowa, 23d to 27th, 31st.

POLAR BANDS.

Polar bands were reported from the following stations:

Arkansas.—Lead Hill, 12th.

California.—Keeler, 1st, 4th, 5th, 25th.

Colorado.—Montrose, 24th, 31st.

Florida.—Archer, 20th, 28th, 30th.

Illinois.—Riley, 3d, 6th, 9th.

Iowa.—Cedar Rapids, 4th, 26th, 29th.

Kansas.—Allison, 5th; Salina, 14th, 15th, 17th, 23d, 29th.

Maine.—Gardiner, 7th, 9th, 11th, 13th.

Ohio.—Wauseon, 6th, 7th, 10th, 16th; Napoleon, 6th, 7th, 10th, 21st, 27th.

Tennessee.—Nashville, 5th, 6th.

Texas.—Abilene, 5th, 18th.

Virginia.—Dale Enterprise, 12th.

SAND STORMS.

Fort Grant, Arizona: a southeasterly gale set in at 11 a. m. of the 17th and continued until midnight, the wind blowing at a rate varying from thirty to forty-two miles per hour. The

high wind raised dense clouds of sand which nearly obscured the sun.

Abilene, Texas: during the 18th fresh southwest winds prevailed, increasing in force at night, and accompanied by heavy clouds of sand and dust. On the 19th a southwesterly gale set in, filling the atmosphere with sand to such an extent that the sun could not be seen until two hours after sunrise, and throughout the remainder of the day the sky was obscured to an altitude of 45° above the horizon. High winds, with heavy clouds of sand and dust, occurred also on the 7th, 16th, 19th, 25th, and 29th.

Sand storms also occurred at the following stations:
Rio Grande City, Texas, 17th, 19th, 20th, 21st, 23d, 27th.
Midland, Texas, 7th, 12th, 16th, 20th, 22d, 25th, 30th.
Corsicana, Texas, 19th.
Keeler, California, 27th.

SUN SPOTS.

Mr. H. Govey, of North Lewisburg, Champaign county, Ohio, reports having observed sun spots on the 3d, 22d, 24th, and 29th.

M. A. Veeder, M. D., of Lyons, New York, gives the following observations in regard to points of the character indicated by him in the MONTHLY WEATHER REVIEW for October, 1886, on page 296:

On January 10th the ship "Constance" was struck by lightning, in latitude 40° north, longitude 68° west; and on that and the following day earthquake tremors were felt at Summerville, South Carolina, in West Virginia, and at San Francisco. The suspended magnet, as observed at Lyons, New York, at once acquired an average deflection of about a degree and a half westward, the daily range of movement from the point thus established being less than a quarter of a degree. This continued until February 1st, when a very active solar disturbance came into view by rotation, and unusual electrical storms occurred in the Ohio Valley and eastward, continuing from February 1st to February 4th, and was followed by earthquake shocks in Indiana on the 6th. On February 1st the range of movement of the magnet increased, until on the 5th it was a degree and a half, the magnet then returning for the first time to the position it had occupied previous to January 11th.

VERIFICATIONS.

INDICATIONS.

The predictions for January, 1887, were made by 2d Lieutenant F. M. M. Beall, Signal Corps, U. S. Army, Assistant, and were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant.

The detailed comparison of the tri-daily indications for January, 1887, with the telegraphic reports of the twenty-four hours for which the indications were prepared, shows the general average percentage of verifications to be 73.63. The percentages for the different elements are: Weather, 72.20; wind, 70.26; temperature, 76.25. By states, etc., the percentages are: For Maine, 69.68; New Hampshire, 70.40; Vermont, 67.18; Massachusetts, 70.27; Rhode Island, 67.68; Connecticut, 70.81; New York, 72.69; Pennsylvania, 73.17; New Jersey, 77.63; Delaware, 74.60; Maryland, 76.50; District of Columbia, 73.71; Virginia, 73.61; North Carolina, 78.28; South Carolina, 78.15; Georgia, 81.32; Florida, 75.60; Alabama, 76.53; Mississippi, 72.03; Louisiana, 72.02; Texas, 73.71; Arkansas, 74.25; Tennessee, 75.00; Kentucky, 74.09; Ohio, 71.91; West Virginia, 63.84; Indiana, 74.19; Illinois, 76.37; Michigan, 75.19; Wisconsin, 72.61; Minnesota, 77.18; Iowa, 75.59; Kansas, 74.38; Nebraska, 70.97; Missouri, 79.27; Colorado, 63.47; east Dakota, 68.77.

There were seventeen omissions to predict, out of 9,951, or 0.17 per cent. Of the 9,934 predictions that have been made, eight hundred and eighty-eight, or 8.94 per cent., are considered to have entirely failed; six hundred and forty six, or 6.50 per cent., were one-fourth verified; 1,809, or 18.21 per cent., were one-half verified; 1,661, or 16.72 per cent., were three-fourths verified; 4,930, or 49.63 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

Below are given for the Pacific coast the percentages of indications verified for December, 1886; this data was received too late for publication in the REVIEW of that date. The

predictions were made by 2d Lieutenant W. A. Glassford, Signal Corps, U. S. Army, Assistant; they were verified by 2d Lieutenant F. M. M. Beall, Signal Corps, U. S. Army, Assistant. The percentages for the different districts are: Washington Territory, 76.89; Oregon, 68.15; northern California, 78.05; southern California, 82.15.

CAUTIONARY SIGNALS.

Of the total number of signals ordered during January, 1887, it was practical to determine the verifications of one hundred and fifty-two; of these, one hundred and thirty-three, or 87.50 per cent., were fully verified both as to direction and velocity. Number of signals ordered for northeast winds, one; verified, none. Number of signals ordered for southwest winds, twenty-one; fully verified both as to direction and velocity, twenty, or 95.24 per cent. Number of signals ordered for northwest winds, ninety-nine; fully verified both as to direction and velocity, eighty-six, or 86.87 per cent. Number of signals ordered for winds without regard to direction, thirty-one; verified, twenty-seven, or 87.10 per cent. Number of signals ordered late, *i. e.*, after the verifying velocity had begun, eighteen, or 11.84 per cent.

In addition to the above, three hundred and forty-one signals were ordered at display stations, the verifications of which it was impracticable to determine.

In forty-one instances winds were reported which would have justified the display of cautionary signals, but for which no signals were ordered, and in four instances winds which would have justified the display of on-shore signals, but for which no signals were ordered.

COLD-WAVE SIGNALS.

Total number of cold-wave signals ordered, the verifications of which were determined, was two hundred and seventy-six; verified, two hundred, or 72.10 per cent. Seventy-two signals were ordered, the verifications of which it was impracticable to determine. In addition to the above, in twelve hundred and sixty-seven instances, the signals ordered from this office were repeated by the observers at the regular stations to towns in their vicinity. The verifications of these it was impracticable to determine.

RAILWAY WEATHER SIGNALS.

P. H. Mell, jr., director of the "Alabama Weather Service," in the report for January, 1887, states:

The verification of predictions for the whole area was 71 per cent. for temperature, and 83.4 per cent. for weather.

The following corporations comprise this system: South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus and Western; Atlanta and West Point of Georgia; Northeastern of Georgia; Western and Atlantic; East Tennessee, Virginia and Georgia system in Georgia; Montgomery and Eufaula; Pensacola and Selma; Pensacola and Atlantic; the cities of Milledgeville, Georgia, and Talladega, Alabama.

The following is from the "Bulletin of the New England Meteorological Society" for January, 1887:

Verification of weather signals at New Haven was 83.9 per cent. for temperature, 80.6 for weather.

SUMMARY FOR THE YEAR 1886.

In the accompanying table are given for Signal Service stations the normal annual temperatures, as deduced from observations covering periods of from six to sixteen years; the mean temperature of the year 1886 with the departures from the normal; the maximum and minimum temperature of 1886 with the dates of occurrence; the normal yearly precipitation for each station; the total precipitation of 1886 and the departures from the normal.

The mean temperature of the year 1886 is exhibited by the dotted isothermal lines on chart vii; on the same chart are also shown, by the heavy unbroken line, the region in which the mean temperature of the year 1886 coincides with the normal, and, by the light unbroken lines, the departures, either above or below. The total precipitation of the year 1886 is shown on chart viii; in addition to the reports from Signal

Service stations, data from the reports of all voluntary observers and stations of the different state weather services having complete records for the year have been used in preparing this chart.

An examination of chart vii will show that the mean temperature of the year 1886 is below the normal in all districts east of the Mississippi River, and in Arkansas, Louisiana, and eastern Texas; within this area four stations only have a mean temperature greater than the normal, viz., Mount Washington, New Hampshire; Chicago, Illinois; Detroit and Mackinaw City, Michigan. The temperature of the year is especially low in Florida and the south Atlantic and east Gulf states; in these districts the departures range from 3° at Cedar Keys, Florida, and Nashville, Tennessee, to 0° at Palestine, Texas.

The mean temperature of the year 1886 is below the normal at every Signal Service station south of the thirty-eighth parallel and east of the one hundredth meridian. To the westward of the Mississippi River, except in Arkansas, Louisiana, and eastern Texas, the mean temperature of the year is generally normal or slightly above, the greater departures occurring in Dakota and Montana, where they average only 1°.2, and range from 2° at Fort Maginnis, Montana, and Deadwood, Dakota, to 0° at Huron, Dakota. In southern California, southern Arizona, southern New Mexico, and at the stations of Sacramento, California, Winnemucca, Nevada, and Santa Fé, New Mexico, the temperature is slightly below the normal.

The precipitation of the year is below the normal at nearly all Signal Service stations, except those situated in Rhode Island, Connecticut, southern New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, eastern Tennessee, eastern Kentucky, and southern Ohio; at all stations in these states and parts of states an excess of precipitation occurs, except at New Haven, Connecticut, Philadelphia, Pennsylvania, and Cape Henry, Virginia. In Maryland, the District of Columbia, and in the mountainous districts of the states of Virginia, West Virginia, and North Carolina, the excess is over nine inches; at Washington City, it is nearly fifteen inches.

In Iowa, southeastern Minnesota, southwestern Wisconsin, northern Illinois, northern Indiana, northern Missouri, northeastern Kansas, and southeastern Nebraska, the precipitation of the year is more than ten inches below the normal; at Leavenworth, Kansas, the deficiency is 17.05 inches; at Omaha, Nebraska, it is 13.80 inches. During January, February, and March the rainfall of this area was about normal; in April it was below the normal, except in central Iowa; in May, June, and July the rainfall was very small, producing a disastrous drought, the effects of which were felt throughout the remainder of the year, especially in Iowa, where the rainfall was less than two-thirds of the normal amount, and the least observed during many years.

In northeastern and central Texas, southern and western Louisiana, southern Mississippi, southwestern Alabama, and the southwestern part of the Indian Territory the rainfall of the year is also over ten inches below the normal. This drought was especially severe in central Texas, and inflicted large losses on the agricultural and cattle interests. The deficiency in the cotton districts of the south Atlantic and east Gulf states is due to the light rainfalls of September and October. The drought in this section began in August and extended through October, covering a longer period than the drought in the same section two years previous. The deficiency in rainfall occurring as it did, after the cotton plant had about completed its growth, allowed the bolls to open rapidly under the warming influence of the sun's rays, and the farmer was enabled to secure this crop in an unstained condition. While this drought resulted favorably to the cotton crop it proved injurious to crops which had not developed before the drought set in, and especially was its influence felt in the preparation of market gardens and the planting of fall crops.

Extreme temperatures and comparison of the mean temperature and total rainfall of the year 1886, with the normal.

Station.	Temperature.						Precipitation.			
	Normal.	Mean for 1886.	Departure.	Extremes for 1886.			Normal.	Total for 1886.	Departure.	
				Maximum.	Date.	Minimum.				
<i>New England.</i>										
Portland.....	45.7	44.1	-1.6	94.2	July 7	-12.4	Jan. 13	39.75	51.63	+11.88
Mount Washington.....	25.0	27.2	+2.2	68.9	Aug. 27	-39.2	Feb. 27	84.68	67.52	-17.16
Boston.....	48.2	48.1	-0.1	95.4	July 6	-10.1	Jan. 12	48.07	42.14	-5.93
Block Island.....	49.4	49.1	-0.3	80.0	Aug. 13	-1.0	Feb. 5	51.86	54.52	+2.66
New Haven.....	49.7	48.2	-1.5	90.3	July 7	-7.7	Feb. 5	49.89	48.32	-1.57
New London.....	49.3	49.1	-0.2	88.0	July 7	-4.3	Feb. 6	48.74	51.86	+10.12
<i>Mid. Atlantic states.</i>										
Albany.....	48.2	47.7	-0.5	97.0	July 6	-10.7	Feb. 5	37.82	34.01	-3.81
New York City.....	51.2	51.0	-0.2	90.3	July 7	-1.8	Feb. 5	43.48	46.73	+3.25
Atlantic City.....	51.9	51.4	-0.5	86.3	Aug. 2	-2.3	Feb. 5	54.71	44.80	-9.91
Philadelphia.....	53.1	53.0	-0.1	93.8	July 30	-2.4	Feb. 5	40.62	37.24	-3.38
Baltimore.....	55.5	53.5	-2.0	92.2	July 7	-1.1	Feb. 5	42.51	52.11	+9.60
Washington City.....	54.9	53.4	-1.5	92.0	Aug. 27	-2.3	Feb. 5	43.47	58.17	+14.70
Chincoteague.....	54.8	54.5	-0.3	87.9	July 10	2.4	Feb. 5	39.15	45.23	+6.08
Cape Henry.....	58.8	57.0	-1.8	93.8	June 17	5.4	Feb. 5	54.65	44.62	-10.03
Norfolk.....	59.2	56.9	-2.3	93.2	June 17	3.5	Feb. 5	51.06	55.33	+4.27
Lynchburg.....	57.2	54.9	-2.3	94.6	July 30	-2.7	Jan. 13	42.84	51.85	+9.01
<i>South Atlantic states.</i>										
Hatteras.....	61.5	60.2	-1.3	86.0	July 29,	13.0	Feb. 5	73.93	54.72	-19.23
					30, 31					
Fort Macon.....	62.1	60.9	-1.2	87.5	July 31	9.9	Jan. 11	59.80	47.30	-12.50
Wilmington.....	63.2	61.9	-1.3	94.5	July 25	10.0	Feb. 5	57.79	56.43	+1.36
Charlotte.....	60.3	58.1	-2.2	93.7	July 25	-0.6	Jan. 12	54.71	64.60	+9.89
Augusta.....	64.3	61.4	-2.9	100.6	Aug. 15	6.0	Jan. 12	48.97	46.04	-2.93
Charleston.....	65.9	63.7	-2.2	94.0	May 15	10.5	Jan. 11	60.44	35.94	-24.50
Savannah.....	66.8	65.3	-1.5	93.2	June 17	12.0	Jan. 12	54.11	42.68	-11.43
Jacksonville.....	69.2	67.3	-1.9	94.3	June 25	15.3	Jan. 12	57.27	54.86	-2.41
<i>Florida Peninsula.</i>										
Sanford.....	70.5	68.7	-1.8	94.7	June 11	31.0	Jan. 10	49.33	64.77	+15.44
Cedar Keys.....	70.7	67.4	-3.3	92.7	Aug. 15	15.5	Jan. 10	58.26	50.54	-7.72
Key West.....	77.5	73.9	-3.6	100.0	Aug. 4	40.8	Jan. 12	39.71	30.13	-9.58
<i>East Gulf states.</i>										
Atlanta.....	61.3	58.9	-2.4	94.0	Aug. 15, 16	-2.4	Jan. 11	56.36	50.76	-5.60
Montgomery.....	65.4	63.3	-2.1	97.8	Aug. 19	5.4	Jan. 9	53.68	56.23	+2.55
Pensacola.....	68.0	66.1	-1.9	95.6	Aug. 15	14.9	Jan. 9	67.90	62.15	-5.75
Mobile.....	66.9	64.4	-2.5	97.0	Aug. 15	11.0	Jan. 9	65.83	54.25	-11.58
Vicksburg.....	65.6	63.3	-2.3	90.3	Aug. 15	3.1	Jan. 9	60.87	55.89	-4.98
New Orleans.....	69.1	66.1	-3.0	94.7	Aug. 16	15.3	Jan. 9	64.35	54.83	-9.52
<i>West Gulf states.</i>										
Fort Smith.....	59.0	58.0	-1.0	104.5	Aug. 18	-6.9	Jan. 8	42.96	35.33	-7.63
Little Rock.....	62.1	58.9	-3.2	97.8	Aug. 17, 18	-4.8	Jan. 8	56.26	47.47	-8.79
Shreveport.....	65.5	63.9	-1.6	101.2	May 31	1.3	Jan. 9	54.43	44.21	-10.22
Palestine.....	64.5	61.7	-2.8	98.2	Aug. 15	0.0	Jan. 8	45.98	33.21	-12.77
Galveston.....	70.1	68.1	-2.0	94.4	Aug. 23	11.0	Jan. 8	53.03	40.98	-12.05
San Antonio.....	69.1	66.6	-2.5	102.6	July 15	5.8	Jan. 8	32.52	26.22	-6.30
<i>Rio Grande Valley.</i>										
Rio Grande City.....	73.3	72.8	-0.5	106.3	June 19	21.0	Jan. 9	32.02	20.11	-11.91
Brownsville.....	72.0	70.5	-1.5	98.1	Aug. 7	22.5	Jan. 9	32.89	60.06	+27.17
<i>Tennessee.</i>										
Nashville.....	59.5	56.2	-3.3	97.7	Aug. 17	-9.0	Jan. 11	52.90	44.74	-8.16
Memphis.....	61.0	58.9	-2.1	97.8	Aug. 17	-8.0	Jan. 9	54.76	57.72	+2.96
Chattanooga.....	60.0	57.3	-2.7	97.4	Aug. 17	-6.9	Jan. 11	59.38	58.53	+0.85
Knoxville.....	57.2	56.1	-1.1	94.4	July 29	-6.0	Jan. 11	53.93	61.45	+7.52
<i>Ohio Valley.</i>										
Pittsburg.....	51.9	51.9	0.0	95.8	July 7	-4.8	Jan. 12	36.67	39.21	+2.54
Columbus.....	52.1	50.4	-1.7	93.1	July 7	-10.8	Jan. 11	42.34	42.39	+0.05
Indianapolis.....	52.8	51.0	-1.8	94.8	July 29	-15.0	Jan. 10	46.47	39.88	-6.59
Cincinnati.....	55.6	52.5	-3.1	94.7	July 29	-12.4	Jan. 11	43.09	31.35	-11.74
Louisville.....	56.7	54.9	-1.8	96.7	July 29	-7.5	Jan. 11	48.90	40.97	-7.93
<i>Lower Lake region.</i>										
Detroit.....	48.1	45.9	-2.2	92.0	July 29	-3.5	Jan. 11	34.33	24.91	-9.42
Toledo.....	50.0	47.7	-2.3	95.5	July 29	-11.4	Jan. 11	32.77	32.70	-0.07
Sandusky.....	50.4	48.5	-1.9	95.8	July 29	-12.0	Jan. 11	39.54	31.00	-8.54
Cleveland.....	48.8	48.2	-0.6	92.0	July 29	-9.0	Jan. 11	36.10	27.34	-8.76
Erie.....	49.1	47.1	-2.0	90.5	July 29	-11.3	Feb. 5	43.46	37.49	-5.97
Buffalo.....	46.4	45.9	-0.5	86.7	July 4	-12.1	Feb. 5	38.08	44.85	+6.77
Rochester.....	45.7	43.5	-2.2	91.4	Aug. 29	-5.7	Feb. 5	36.17	36.84	+0.67
Oswego.....	47.1	44.5	-2.6	89.0	Aug. 29	-17.2	Jan. 12	35.53	35.46	-0.07
<i>Upper Lake region.</i>										
Duluth.....	39.5	37.7	-1.8	94.0	July 5	-31.7	Jan. 23	33.09	33.37	+0.28
Marquette.....	40.7	37.7	-3.0	97.7	Aug. 9	-17.8	Jan. 23	33.00	29.27	-3.73
Escanaba.....	40.2	39.7	-0.5	86.3	June 29	-21.7	Jan. 24	35.28	32.36	-2.92
Milwaukee.....	44.8	44.0	-0.8	97.5	July 25	-21.8	Jan. 23	33.64	31.46	-2.18
Chicago.....	48.5	49.0	+0.5	94.5	July 6	-14.4	Jan. 23	37.84	26.77	-11.07
Grand Haven.....	46.6	44.9	-1.7	87.0	July 5	-14.6	Feb. 3	39.54	35.31	-4.23
Mackinaw City.....	39.3	41.5	+2.2	92.5	Aug. 9	-19.0	Feb. 4	36.37	23.39	-12.98
Alpena.....	40.9	40.5	-0.4	98.3	July 6	-23.0	Feb. 5	37.73	40.12	+2.39
Port Huron.....	44.9	44.3	-0.6	91.3	July 6	-13.0	Feb. 5	34.57	29.81	-4.76
<i>Extreme Northwest.</i>										
Fort Buford.....	38.5	40.1	+1.6	105.9	July 12	-48.3	Jan. 22	14.76	10.24	-4.52
Bismarck.....	39.4	40.6	+1.2	104.4	Aug. 24	-36.9	Jan. 22	20.73	13.26	-7.46
Moorehead.....	36.7	37.6	+0.9	100.1	Aug. 24	-37.0	Feb. 2	27.91	26.76	-1.15
Saint Vincent.....	33.2	35.0	+1.8	103.9	Aug. 24	-40.7	Jan. 9	18.85	15.04	-3.81
<i>Upper Miss Valley.</i>										
Saint Paul.....	43.8	42.6	-1.2	94.2	Aug. 12	-33.9	Jan. 23	39.26	22.89	-16.37
LaCrosse.....	46.5	46.9	+0.4	95.5	July 5	-28.0	Feb. 3	34.07	22.49	-11.58
Dubuque.....	47.8	45.9	-1.9	100.4	July 6	-23.5	Dec. 27	39.78	27.51	-12.27
Davenport.....	49.3	48.2	-1.1	97.6	July 6	-21.6	Dec. 27	36.00	23.15	-12.85
Des Moines.....	45.4	49.3	+3.9	104.4	July 6	-24.0	Jan. 9	41.39	29.53	-11.86
Keokuk.....	51.6	50.5	-1.1	99.1	Aug. 12	-18.7	Jan. 9	37.91	29.56	-8.35
Springfield.....	52.6	53.0	+0.4	99.4	Aug. 16	-12.9	Jan. 9	46.04	31.69	-14.35
Saint Louis.....	55.3	56.4	+1.1	102.0	Aug. 16	-8.2	Jan. 9	38.31	44.34	+6.03
Cairo.....	58.0	58.4	+0.4	97.0	Aug. 17	-9.0	Jan. 9	45.69	37.98	-7.71

Extreme temperatures and comparison, etc.—Continued.

Stations.	Temperature.						Precipitation.		
	Extremes for 1886.								
	Normal.	Mean for 1886.	Departure.	Maximum.	Date.	Minimum.	Date.	Normal.	Total for 1886.
<i>Missouri Valley.</i>	0	0	0	0		0			
Yankton.....	45.5	45.4	-0.1	102.7	July 13	-27.5	Jan. 9	28.37	29.15
Huron.....	41.8	42.1	+0.3	103.6	July 12	-32.5	Jan. 9	24.50	20.25
Omaha.....	49.5	48.2	-1.3	100.0	July 13	-24.1	Jan. 9	36.47	22.67
Leavenworth.....	53.1	52.4	-0.7	105.8	Aug. 16	-20.5	Jan. 9	39.30	22.25
<i>Northern slope.</i>									
Fort Assinaboine.....	41.3	43.1	+1.8	108.4	July 12	-49.3	Jan. 22	14.17	11.48
Helena.....	43.2	43.6	+0.4	103.1	July 12	-30.2	Jan. 7	15.38	12.63
Fort Custer.....	44.1	44.8	+0.7	105.0	July 15	-38.3	Jan. 17	13.94	13.25
Fort Maginnis.....	40.4	42.5	+2.1	104.0	July 12	-33.2	Jan. 21, 29	12.08	15.44
Deadwood.....	41.6	43.7	+2.1	96.0	July 10	-23.7	Jan. 7	26.45	25.67
North Platte.....	47.6	48.2	+0.6	102.4	July 15	-21.2	Jan. 8	19.57	13.10
<i>Middle slope.</i>									
Denver.....	49.2	49.3	+0.1	95.3	July 15	-18.9	Jan. 8	15.06	16.07
Pike's Peak.....	19.1	19.8	+0.7	57.3	Oct. 1	-29.8	Jan. 7	29.65	29.51
Dodge City.....	52.7	52.5	-0.2	100.2	July 15	-16.2	Jan. 8	21.35	19.35
Las Animas.....	49.5	49.6	+0.1	104.4	July 3	-21.5	Jan. 8	13.62	12.78
Fort Elliott.....	54.6	56.0	+1.4	101.7	July 10	-9.6	Jan. 8	24.59	21.65
<i>Southern slope.</i>									
Fort Sill.....	60.2	60.0	-0.2	106.0	July 16	-5.0	Jan. 8	33.33	19.57
Fort Davis.....	60.0	61.0	+1.0	101.7	July 18	-3.2	Jan. 8	19.50	12.64
<i>Southern plateau.</i>									
Prescott.....	52.2	52.4	+0.2	96.1	July 7	-2.0	Nov. 23	15.38	18.78
Fort Grant.....	60.1	59.6	-0.5	99.6	July 14	12.1	Jan. 3	16.15	19.32
Fort Thomas.....	61.5	62.1	+0.6	108.2	Aug. 9	12.4	Jan. 3	11.96	10.86
Fort Apache.....	52.3	53.8	+1.5	100.6	June 30	-9.5	Jan. 3	22.69	21.06
El Paso.....	63.2	63.1	-0.1	111.5	July 22	11.0	Jan. 8	12.31	8.06
Santa Fe.....	47.9	47.6	-0.3	93.0	July 18	-6.5	Jan. 8	13.97	15.90
Yuma.....	71.9	71.0	-0.9	112.4	July 13	30.4	Jan. 6	2.54	5.35
<i>Middle plateau.</i>									
Salt Lake City.....	51.2	51.6	+0.4	99.1	Aug. 11	-2.0	Jan. 8	17.22	18.89
Winnemucca.....	49.4	49.1	-0.3	100.2	July 11	0.6	Nov. 16	9.98	8.16
<i>Northern plateau.</i>									
Spokane Falls.....	47.3	48.7	+1.4	100.3	July 16	-10.5	Jan. 20	21.75	15.86
<i>N. Pac. coast region.</i>									
Olympic.....	49.5	50.2	+0.7	91.9	June 2	15.1	Jan. 17	54.22	48.13
Portland.....	52.5	52.6	+0.1	95.0	June 2	15.0	Jan. 19	52.40	38.76
Roseburg.....	52.2	52.7	+0.5	100.0	July 18	22.3	Nov. 16	35.12	35.17
<i>Mid. Pac. coast reg.</i>									
Cape Mendocino.....	51.7	51.8	+0.1	85.4	Sept. 9	33.7	Jan. 17	18.78	22.35
Sacramento.....	59.4	58.8	-0.6	105.0	July 14	27.5	Jan. 7	23.21	18.17
San Francisco.....	55.8	56.1	+0.3	93.9	Sept. 8	41.0	†	23.97	20.02
<i>S. Pac. coast region.</i>									
Los Angeles.....	60.8	61.1	+0.3	98.1	July 15	32.0	Jan. 2	17.31	17.20
San Diego.....	60.6	60.5	-0.1	82.5	Aug. 29	34.8	Jan. 2	9.08	15.35

* Two days of March and eleven days of April missing.

† January 2d, 3d, 4th, 8th; February 28th; March 18th.

STATE WEATHER SERVICES.

The following is an extract from the January, 1887, report of the "Alabama Weather Service," P. H. Mell, jr., of the Agricultural and Mechanical College, Auburn, director:

The low temperature prevailing throughout the month has rendered January memorable. The average for the state shows a fall of 5° below the normal. There were four cold waves predicted, and all verified with remarkable accuracy, except the one predicted on the 6th. The second occurred on the 10th, the temperature falling from 45° to 20°; the third struck the state on the 18th, when the temperature ranged from 65° to 22°; the fourth reached the state on the 27th, and the temperature fell from 56° to 28°. These cold waves are so accurately predicted now, the people watch the display of the signals with considerable faith and interest.

The precipitation was very nearly normal, 0.26 inch below. There was a slight fall of snow throughout the state on the 1st, 4th, and 5th.

Carrollton furnishes the following note of interest: "At sunrise on the 12th there was an intense fog and no frost. At 9 o'clock the fog suddenly disappeared and the ground at that hour was covered with a thick white frost."

High winds occurred at frequent intervals during the month, and some of them swept with dangerous velocities. Trinity and Tusculum report a heavy wind and rain storm on the 13th, attended with hail, thunder, and lightning. The wind blew down fences and trees.

Summary.

Mean temperature, 42°; highest temperature, 77°, at Eufaula, on the 31st; lowest temperature, 1°, at Gadsden, on the 3d; range of temperature, 76°; greatest monthly range of temperature, 59°, at Gadsden; least monthly range of temperature, 50°, at Fayette; mean daily range, 15°; greatest daily range of temperature, 47°, at Eufaula, on the 19th; least daily range of temperature, 0°, on the 9th, at Centre, Demopolis, Gadsden, and Valley Head, and at Mount Willing, on the 8th.

Mean depth of rainfall, 4.22 inches; mean daily rainfall, 0.14 inch; greatest depth of monthly rainfall, 7.55 inches, at Greenville; least depth of monthly rainfall, 2.38 inches, at Gadsden; greatest daily local rainfall, 5.00 inches, at Fayette, on the 23d.

Average number of days on which rain fell, 6; average number of cloudy

days, 10; average number of fair days, 10; average number of clear days, 11. Prevailing direction of wind, south.

The following extracts are from the January, 1887, report of the "Arkansas Weather Service," Mr. George R. Brown, of Little Rock, director:

Heretofore there has been no reliable data of the climate of Arkansas published, except at Little Rock and Fort Smith, and in a few of the local papers. Persons away from the state have been guided entirely by this. Situated as the state is, with mountains, valleys, and extensive prairies, it is obvious that records kept at a few points can give but a very imperfect idea of the climate of the state. It is now desired to obtain reports from every county. These reports can be made with very little trouble and with little expense. Some few have sent in reports for January, and more have promised to do so for February.

The highest temperature reported was 74°, at Mount Ida, on the 20th; lowest, -13°, on the 3d. It was -8° on the 9th at Eureka Springs, and -2° on the 2d. At Conway on the morning of the 10th it was 0°, and -6° at Van Buren on the 3d.

The cold-wave flag was up at the 1st of the month for a cold wave which reached the northern part of the state on the 1st, and was general throughout the state from the 2d to 4th; the lowest temperature recorded being -13°, at Mount Ida on the morning of the 3d, -2° at Eureka Springs, and 7° at Little Rock.

Snow was reported on the 2d at Pine Bluff, Mount Ida, and Little Rock. Snow and sleet on the 8th at Pine Bluff, Mount Ida, Conway, Eureka Springs, Little Rock, and Judsonia.

Thunder-storms were frequent in different parts of the state from the 13th to the 25th, especially on the 21st and 22d; these storms were preceded by brisk winds on the 12th and 13th in nearly all parts of the state, and during this time the temperature was generally above the average for the season.

The greatest rainfall reported was on the 22d, Mount Ida, 2 inches, and Little Rock, 1.46 inches.

The following is an extract from the January, 1887, "Monthly Review of the Illinois Weather Service," Col. Charles F. Mills, of Springfield, director:

Temperature.—The mean temperature of the state, 20° 1, was 2° 7 below the January normal for thirteen years (January, 1875, 15° 4, being the coldest, and January, 1880, 40° 8, the warmest). The mean for the northern counties was 14° 5; central, 19° 7; and southern, 27° 6. The lowest mean temperature reported was 10° 9, from Belvidere; the highest, 33° 4, from Cairo (a range of 22° 5 in 375 miles of territory, or a fall of one degree for each sixteen and two-third miles of latitude going south).

There were three severe cold waves, on 2-3d, 7th, and 18th; the minimum temperature reported from that of the 2d being 26° below zero; of the 7th, 32° below; and of the 18th, 16° below. The northern counties were affected most by that of the 7th, and the central and southern counties by that of the 2-3d.

The mean temperature was nearly normal, except in the extreme northern counties, where it averaged about 6° below.

The highest temperature reported during the month was 66° 1, on the 20th, from Cairo; the lowest, -32°, on the 7th, from Lacon.

The cold waves predicted, were, as a rule, justified.

Precipitation.—The average precipitation for the state for the month, 1.82, was 0.30 below the normal January precipitation for past ten years. The average for the northern counties, 2.64, was 0.80 above; central, 1.27, was 0.35 below; and southern, 1.39, was 1.41 below.

The remarkable feature of the month was the number of well-defined storm-centres that passed over the state (4th, 13th, 16th, 20th, 22-23d, and 24-25th) and the general deficiency in precipitation, notwithstanding.

A general thunder-storm, accompanied by heavy rain, and in several counties by hail, prevailed on the 22d. Northwest to southwest winds prevailed.

The snowfall was comparatively light, except in the extreme northern part of the state, where it ranged from ten to twenty-seven inches. About six inches fell in the central and three in the southern counties. Frosts were general, except on the 22d.

The following is an extract from the January, 1887, report of the "Minnesota Weather Service," Prof. Wm. W. Payne, Carleton College, Northfield, director:

The month has been very severe, the temperatures were remarkably low, and the snowfall rather heavy in some localities. There were five periods of general precipitation throughout the state, these occurring from the 3d to the 5th, 10th to 16th, 19th and 20th, the 24th and the 29th. The greatest amount of snow fell during the second of these periods. With these exceptions, fair weather prevailed.

Temperature.—The mean for the month was 0° 1 above zero. At Saint Paul it was 9° 8 below the average of the corresponding month for sixteen years, and the lowest since January, 1875, when it was 2° 3 below zero. At Saint Vincent the mean was 6° 7 below the average, and the coldest month but one since the station was established in 1873, January, 1883, being 0° 7 colder. Duluth was 7° 9 below the average, and La Crosse 4° 3 below. The lowest temperature recorded at any station was 42° 2 below zero on the 6th at Saint Vincent, while on the succeeding day Rochester reported 42° 0 below; Albert Lea and Eau Claire 40° below. The lowest temperatures occurred mainly

during the periods of the 1st and 2d, 5th to 10th, 17th and 18th, 25th and 26th, 30th and 31st, the mean temperature on these days being considerably below zero. In the northeastern portion of the state the minimum temperature for the month occurred during the fifth period, and in other portions during the second period. The maximum temperatures occurred mainly on the 27th and 28th; the highest was 41° 0, and reported on the former date from La Crosse. The monthly range of temperature for the state was 83° 2; the greatest range for any station, was 82° 0, at Rochester, and the least range, 61° 8, at Duluth.

Precipitation.—This has been entirely in the form of snow. In Minnesota there was an excess over the average of previous years, but considerably below that of the corresponding month of 1886. At La Crosse the total fall (in inches) was only 0.25; which is the lowest since the station was established in 1873, and 0.99 below the average. At Saint Vincent there was an excess of 0.85; Duluth, 0.52; Saint Paul, 0.81. The greatest amount of precipitation was 2.25 inches, reported from Excelsior. Other stations reporting over an inch were Saint Paul, 1.79; Eau Claire, 1.75; Duluth, 1.62; Red Wing, 1.22; Mankato, 1.15; Northfield, 1.01. The snowfall was about one-fifth as much as fell in January, 1886. North of a line taken from Mankato to Red Wing, the fall amounted to over ten inches, while to the west and south it was considerably less. At the close of the month, from five to twenty-two inches of snow remained on the ground, the greatest amount being in the central portion of the state.

The following is from the January, 1887, report of the "Mississippi Weather Service," Prof. R. B. Fulton, of the University of Mississippi, Oxford, director:

Temperature.—The mean temperature for the state was 44°; 41° for the northern portion, 44° for the central portion, and 48° for the southern portion, which is 3° above the average of last year. The maximum temperatures occurred on the 21st and 31st, the minimum occurred at every station in the state on the 3d.

Precipitation.—The following heavy rainfalls (1.00 or more) were reported: Brookhaven, Lincoln county, 2.48 inches, on the 23d, and 1.20 on the 29th; Mobile, 1.09 inches, on the 23d; Memphis, 1.27 inches, on the 22d, 1.84 on the 23d, and 1.56 on the 28th; Agricultural and Mechanical College, Oktibeha county, 1.00 inch, on the 23d; Vicksburg, Warren county, 1.09 inches, on the 29th; Kosciusko, Attala county, 1.00 inch, on the 24th; Oxford, Lafayette county, 2.30 inches, on the 22d, and 1.83 on the 28th; Biloxi, Harrison county, 2.17 inches on the 23d; Astonish Plantation, Wilkinson county, 1.62 inches, on the 22d, and 1.34 on the 28th; Greenville, Washington county, 1.70 inches, on the 23d, and 1.35 on the 29th.

Summary.

Mean temperature, 44°; highest temperature, 77°, on the 30th, at Greenville; lowest temperature, 2°, on the 3d, at Batesville; monthly range of temperature, 75°; greatest daily range of temperature, 47°, at the Agricultural and Mechanical College, on the 20th; least daily range of temperature, 1°, at Holly Springs, on the 22d.

Mean monthly rainfall, 3.78 inches; greatest monthly rainfall, 4.99 inches, at Oxford; least monthly rainfall, 2.36 inches, at the Agricultural and Mechanical College; average number of days on which rain fell, 7.

The following is an extract from the January, 1887, report of the "Missouri Weather Service," Prof. Francis E. Nipher, Washington University, Saint Louis, director:

The rule that a cold January and February follows a cold December has so far been verified. January, 1887, has had a mean temperature of 27° 2, which is 4° 6 below the normal temperature. The lowest temperature was —15° 1 on the 2d, and the highest was 62° 5, on the 20th. The temperature fell below zero on four days; below the freezing point on twenty-one days; and did not rise above freezing on twelve days during the month. The mean temperatures of the decades were 9° 6 for the first; 32° 3 for the second; and 38° 6 for the third.

The rainfall and melted snow was only 0.70 of an inch, which is 1.39 inches below the normal for Saint Louis. Snow fell on five days during the month, which all amounted to about 0.35 inch when melted.

The highest temperatures generally occurred on the 20th, and the lowest on the 2d.

At Craig the temperature fell below zero on thirteen days; on nine days the mean temperature was below zero, and fell below freezing on every day of the month. Louisiana reports the temperature below zero on twelve days, and not rising above on six days during the month.

The rainfall in the state was over two inches in central and southern portions, diminishing to less than one inch in the northwest. The maximum fall occurred at Springfield, it being 2.60 inches.

The following is from the January, 1887, report of the "Nebraska Weather Service," Prof. Goodwin D. Swezey, of Doane College, Crete, director:

The month of January, 1887, has been remarkable for unusually low temperatures, for absence of rain, and for light snowfall, although the number of days of snow was as large as usual.

Precipitation.—The precipitation has been most deficient in the central part of the state, being a small fraction of an inch of melted snow, representing only a few inches of snowfall. From southern Pawnee county, only, is reported more than an inch of precipitation; in the eastern and western parts

of the state generally a little less than an inch. On the whole the precipitation has been less than for any January of the past ten years.

Temperature.—The mean temperature of the month has been 18° 1, which is 4° 6 below the normal. The average noon temperature has been 23° 5, the normal for noon temperature of January being 27° 4. There has been an unusual number of cold days, there being thirteen days in which the thermometer went below zero against an average of 8.6, while every day the temperature went as low as the freezing point. The highest temperature recorded was 59° 5, on the 21st, at Crete, and the lowest was 30° below zero, at Valentine, on the 6th.

Three severe cold waves prevailed; the first on the 1st and 2d, when the barometer rose to the unusual height of 30.944 inches at the central station, and the temperature reached the lowest point of the month for the eastern part of the state, being —21° 8 at Crete, —21° 9 at Omaha, and —22° at Lincoln. The second passed on the 8th, when the lowest temperature of the month for the western part of the state was reached, —30° at Valentine and —21° 4 at North Platte. The third cold wave, less severe than the others, passed on the 18th.

Wind.—No very severe wind storms have been felt, the highest velocity reported being forty-four miles at Valentine.

The following extracts are from the January, 1887, report of the "New England Meteorological Society," Prof. Wm. H. Niles, of the Institute of Technology, Boston, Massachusetts, president:

Reports for the month were received from one hundred and fifty observers.

The mean temperature of the month was decidedly below the average, as was generally the case throughout the country; the first nineteen days were chiefly responsible for this, as the last twelve were generally warmer and contained two periods of decidedly high temperature. The precipitation was strongly in excess of the average for January, being snow in greatest part during the colder days, and rain afterwards, by which the previous abundant snow was greatly reduced.

The weather of the month was affected by the passage of fourteen cyclonic storms.

January 1st had moderate temperature (maximum, 30° to 40°) and general rain, with snow in the north, lasting over to the 2d in Maine, as the last storm of December moved along the coast. Fair weather and northwest winds followed, with severe cold on the 4th (zero in south, —25° to —30° in north), succeeded by two storms passing either side of New England on the night of the 5-6th, giving snow, except at southern coast stations, with moderate temperature again. * * * The 17th brought another snowfall, with some rain, as a strong cyclonic storm moved from Lake Huron down the Saint Lawrence, followed by brisk northwest winds and a rapid fall of temperature through the 18th to the morning of the 19th, when the third cold spell gave the general minimum of the month: 0° to 4° on the southern coast and islands; —15° to —35° in the interior; Post Mills, Vermont, had —42°, with a spirit thermometer; Quincy, New Hampshire, —36°; Mount Washington, New Hampshire, —35°. Many observers report striking instances of inverted temperatures between hills and valleys; Waterbury, Connecticut, found strong variations in a distance of half a mile, varying in very regular graduation from —25° at the lowest point to zero two hundred feet higher on the hills. At Windsor, Vermont, two adjacent self-registering thermometers gave —33° 3 and 32° 9 (corrections applied); other thermometers on low lands gave —38° to —40°. At Lexington, Massachusetts, one thermometer, eight feet from the ground, read —15° at 7 h.; another, thirty feet from ground, on the same building, read —7°; the two agreed when placed together. The low temperature of this date was curious in occurring with high pressure (30.5) on the Atlantic off Georgia, and low pressure (29.6) north of Lake Huron.

Only clouds reached us from this northern low pressure area, but on the 20th a stronger storm, the tenth, came from the Lakes, giving general cloudiness, southerly winds, snow in the north, with moderate temperatures, rising through the night to the 21st, when maxima of 40° to 48° were commonly noted. At Windsor, Vermont, the temperature thus rose 81° in about forty-two hours. The 21st was clear and pleasant, with a moderately cold night. The 22d clouded over on the approach of the eleventh cyclonic storm from the southwest, giving warm southerly "sirocco" winds (maximum for the month, 35° to 58°) and rain on the 23d and 24th, under which the snow on the ground rapidly diminished. The change to colder, westerly winds came about noon, at Bethlehem, New Hampshire, and at 14 h. 20 m. at Cambridge; thunder was heard at 12 h.—13 h. in northern Rhode Island, and 13 h.—14 h. in eastern Massachusetts. * * * Lightning was seen at Taunton, Massachusetts, about midnight, 28-29th. The highest temperature was reached in the morning (about 6 h.) of the 29th in northern New Hampshire, and at 13 h.—14 h. at Cambridge; the westerly winds which followed failed to bring severe cold, as they were soon reversed by another storm (the fourteenth of the month) passing down the Saint Lawrence Valley on the 30th, continuing the clouds and rain of the previous days. The 31st was fair, but halos at noon announced the coming of another storm, that reached us from the southwest on February 1st. A brilliant meteor was seen at several stations moving slowly northward at 17 h. 14 m. on the 3d.

Summary for 1886.

The most noteworthy features of the year 1886 were the severe cold wave of January 11th and 12th; the heavy rains of February 10th to 14th; the high winds of February 25th to March 3d; the deficiency of rainfall and the moderate mean temperatures of June, July, and August; the moderate number of thunder-storms in these summer months, and the occurrence of several violent

thunder-storms in southern New England late in the autumn; and heavy snow-fall early in December, marking the opening of a severe winter.

The following is an extract from the January, 1887, report of the "New Jersey Weather Service," Prof. George H. Cook of the Agricultural College, New Brunswick, director:

The mean temperature at ten stations, Atlantic City, Dover, Moorestown, Newark, New Brunswick, New York, Philadelphia, Princeton, Somerville, and South Orange, as compared with the normal January mean temperatures as given in Signal Service reports, Prof J. C. Smock's tables, and other reliable sources, shows that the mean temperature throughout the state was but a half degree below the normal.

The first ten days were very cold; the following were warmer, but still quite cold; and the last eleven were comparatively comfortable, considered in the light of history, as reflected by our valuable observer at Somerville, who says: "Thirty years ago, on Sunday, January 16th, there was a snow storm remarkable for the intense cold and amount of snow. Snow fell three feet deep on a level on Main street, Somerville. Cars did not get up from New York until Wednesday evening, January 19th. A train of eight engines, a mail car, and a passenger car came as far as this place. The mercury was four degrees below zero. People rode in sleighs to church from over the river for thirteen Sundays after the storm, but sleighing in town ceased two weeks sooner."

The maximum temperature for the month was reported at Red Bank, 73°, on the 23d, and the lowest at Blairstown, 6° below zero, on the 8th. Matawan showed the highest mean temperature for the month, 33°.7, while Blairstown recorded the lowest, 22°.7.

Rain or snow fell at each station on an average of ten days out of thirty-one. Sixteen stations noting amount of cloudiness report an average of twelve days when the amount of cloudiness averaged eight or more on a scale of zero to ten. The greatest amount of sunshine was reported at Atlantic City, Red Bank, Egg Harbor City, and Philadelphia, while Dover recorded the greatest number of cloudy days. The precipitation was unevenly distributed. Out of a list of eleven stations where normals have been determined eight stations report an excess, while three show a deficiency. The average excess throughout was 0.97 inch. The ground was reported perfectly free from snow, except in the northern counties, at the end of the month, and the frost was out in a number of places.

Thunder-storms.—The observer at Lockton reports thunder and lightning at 3 a. m. of the 14th, and the Princeton observer notes a thunder-storm at 2 a. m. on the 18th.

Navigation.—The ice moved out of the Raritan, at Somerville and New Brunswick, on the 15th. The ice in Paulin's Kill, at Blairstown, broke up and flowed out on the 29th. Ice in the Delaware, at Billingsport Front light-house, broke up on the 24th, and at the end of the month the river was clear.

The following meteorological summary for January, 1887, is from the "Bulletin of the North Carolina Department of Agriculture." The weather service is under the direction of Dr. Charles W. Dabney, jr., of Raleigh:

Temperature.—The mean temperature of the state was 39°.1. The characteristic features of the first ten days were decidedly cold; the lowest temperature for the month at many points occurred during this period, especially at Salem, Forsyth county, where the minimum, —4°, was recorded on the 6th. This can be regarded as the lowest in the state during the month, but it was not, however, the coldest day, which occurred on the 3d, when a mean of 17° for all points was recorded. The minimum at Asheville, on this date, stood at 2°, and at Salem, 4°. Minimum temperatures for the state ranged from —4° at Salem, central district, to +15° at Wilmington, eastern district.

With the exception of a second cold snap, 18th to 19th, inclusive, the temperatures were generally normal, or abnormally high, and continued so to the end of the month.

Precipitation.—The average precipitation of the state for the month was 2.92 inches; for the eastern district, 2.81 inches; for the central district, 2.49 inches; and for the western district, 3.94 inches. The precipitation was generally distributed throughout the month, and most points in the state were favored with a fair average rainfall. The heaviest rains, or snows, fell on the 1st, 5th, 13th, 14th, 17th, 23d, 24th, 29th, and 30th. There were eight days during the month noted for an entire absence of rain. Sleet storms prevailed at Raleigh and Reidsville on the 1st, at Weldon on the 5th, at Mount Pleasant on the 6th, at Raleigh on the 10th, at Tarborough on the 26th.

The following meteorological summary for January, 1887, is from the report of the "South Carolina Weather Service," Hon. A. P. Butler, Commissioner of Agriculture for South Carolina, director:

Mean temperature, 40°.1; highest temperature, 73°, at Cheraw, on the 23d; lowest temperature, 5°, at Spartanburg, on the 4th; range of temperature, 68°; greatest daily range of temperature, 38°, at Spartanburg, on the 14th; least daily range of temperature, 2°, at Stateburg, on the 8th.

Mean depth of rainfall, 2.80 inches; greatest monthly rainfall, 4.48 inches, at Aiken; least monthly rainfall, 1.36 inches, at Spartanburg; greatest daily rainfall, 1.08 inches, at Charleston, on the 13th; least daily rainfall (inappreciable), at several stations on the 18th, 23d, and 26th.

Average number of rainy days, 8.

Killing frosts occurred on the 1st to 13th, inclusive, also on the 15th, 16th, 18th, 19th, 20th, 25th, 26th, 27th, 28th, and 31st.

Snow fell generally in the upper and middle divisions of the state on the 5th and 7th; it was also reported in the upper counties on the 8th and 9th. Sleet was reported on the 5th, 7th, and 9th.

Thunder-storms.—On the 23d, at Abbeville, accompanied by high wind, heavy rain, and hail; on the same date at Spartanburg and Yorkville. The observer at Yorkville reports: "From 10 p. m. of the 23d until 4 a. m. of the 24th a rain storm, accompanied by vivid lightning and high wind, prevailed. The wind did some damage to fencing and to small unprotected out-houses."

The following is an extract from the "Tennessee State Board of Health Bulletin" for January, 1887, prepared under the direction of J. D. Plunkett, M. D., President of the State Board of Health. The weather report is prepared by H. C. Bate, Director of the State Meteorological Service:

The meteorological features for January were the severe thunder-storms of the 13th and 23d, the high winds which prevailed at intervals during the month, and the small proportion of cloudiness.

The mean temperature was 37°.2, which was several degrees higher than the January mean of any of the three preceding years. The highest temperature was 73°, recorded on the 21st, and was above the maximum recorded in January of the two preceding years, and only 1° below the maximum recorded for the corresponding month in 1884. The minimum temperature was —2°, recorded on the 2d and 3d, and was the highest minimum recorded in January during the past three years, the next highest being —5°, in 1885. The proportion of cloudiness for the month was the smallest during the past three years.

The mean precipitation for the month was 4.71 inches, which was considerably below the January mean of the past three years, the highest being 6.96 inches, in 1885; of this amount the eastern division received an average of more than 4.50 inches, the middle division an average of nearly 5 inches, and the western division a little more than 4.50 inches. The rains of the 9th, 13th, 23d, and 25th were general, and those of the 23d, 28th, and 29th were very heavy; that of the 23d especially so, the fall amounting to an average of 1.72 inches for the entire state.

Summary.

Mean temperature, 37°.2; highest temperature, 73°, on the 21st, at Riddleton; lowest temperature, —2°, on the 2d, at Nashville, and on the 3d, at Farmingdale; range of temperature, 75°; mean daily range of temperature, 16°.3; greatest daily range of temperature, 39°, on the 8th, at Cookeville; least daily range of temperature, 2°, on the 1st, at Ashwood; on the 18th, at Howell; and on the 22d, at Covington; mean of maximum temperatures, 68°.4; mean of minimum temperatures, 3°.1.

Average number of clear days, 12.4; average number of fair days, 9.6; average number of cloudy days, 9.

Mean depth of rainfall, 4.71 inches; mean daily rainfall, 0.152 inch; days of greatest rainfall, 9th, 13th, 23d, 28th, 29th; day of greatest rainfall, 23d.

NOTES AND EXTRACTS.

SUN SPOTS AND METEOROLOGICAL PHENOMENA.

[Prepared under direction of officer in charge of Review Division by Jr. Prof. H. A. HARRIS.]

In answer to many inquiries regarding a probable connection between sun spots and meteorological phenomena, there is given in this REVIEW, on the back of chart i, a series of curves showing monthly values for fifteen years of the following elements, viz.: (curve A) sunspots, (B) diurnal range of magnetic declination, (C) monthly range of air pressure, (D) mean monthly temperature, (E) clouds, (F) precipitation. Tables I and II give the data from which these curves have been drawn, and these will enable any one to study the original data as he may wish. The following description of the sources of information and the manner of discussion is given:

The period covered by the fifteen years is that from January, 1872, to December, 1886, comprising nearly all of the observations of the Signal Service. Wolf's sun spot numbers have been taken from January, 1872, to July, 1873; from August, 1873, to May, 1877, the Greenwich observations of sun spots have been used, and from June, 1877, to December, 1886, the observations of Prof. D. P. Todd, as published month by month in past MONTHLY WEATHER REVIEWS, have been utilized. The first two have been reduced to correspond, as nearly as possible, with the values in the longest series.

The mean monthly diurnal range of magnetic declination is the mean of the values at Milan and Prague, as these were nearly identical. In 1884 and 1885 the values at Prague, only, were at hand. The remaining elements are taken from the Signal Service observations at Saint Paul, Davenport, Saint Louis, Cairo, Memphis, Vicksburg, and New Orleans. A mean of these seven stations would serve to eliminate local peculiarities, and give a much more satisfactory result than a single station could. These are given in Table I. The fifteen-year normal for each month is obtained in the usual way.

The general mean is then obtained by finding the mean of these twelve normals. The algebraic difference between the general mean and the normal for any one month may be regarded as a correction to be applied to each of the fifteen monthly values. By the application of the correction to each month the seasonal variation is approximately eliminated. The correction for the seasonal variation of the meteorological elements is placed at the foot of each month in Table I. It was found that the corrected monthly values when projected gave curves which were difficult to compare, because of great irregularities from month to month. In order, then, to smooth out many of these sudden turns, a mean of each five consecutive months has been taken, and these are shown in Table II, from which the curves are drawn.

MONTHLY WEATHER REVIEW.

JANUARY, 1887.

TABLE I.—Mean monthly data from January 1872, to December 1886.

Year.	Sun spots.												Magnetic declination.												Range of air pressure (inches).											
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1873	40	66	44	50	54	55	58	43	27	53	56	42	10.5	9.5	10.1	10.9	10.7	11.0	11.0	12.0	10.9	8.9	10.1	9.5	.93	1.02	1.07	.89	.74	.56	.42	.39	.61	.58	.90	.92
1874	43	54	32	23	23	22	33	34	33	23	39	25	10.1	9.1	9.9	10.3	8.4	8.6	8.7	8.6	8.2	7.8	8.2	8.4	1.05	1.04	1.12	.74	.72	.55	.43	.42	.60	.77	1.08	.99
1875	30	27	17	16	6	12	9	8	4	7	9	5	5.9	6.1	5.6	5.5	6.3	5.7	5.7	7.5	8.2	6.9	7.0	6.6	1.16	1.08	1.04	.83	.64	.50	.47	.45	.53	.77	.91	
1876	13	11	17	16	6	12	9	8	4	7	9	5	5.9	6.1	5.6	5.5	6.3	5.7	5.7	6.7	7.1	6.1	6.4	7.0	.91	1.18	1.00	.69	.87	.53	.45	.53	.77	.91		
1877	9	9	17	16	6	12	9	8	4	7	9	5	5.9	6.1	5.6	5.5	6.3	5.7	5.7	6.7	7.1	6.1	6.4	7.0	.91	1.18	1.00	.69	.87	.53	.45	.53	.77	.91		
1878	13	4	8	9	11	11	11	11	11	11	11	11	6.8	5.8	5.3	4.3	5.3	5.7	6.0	5.9	5.4	5.7	6.1	6.6	.90	.96	1.00	1.04	.57	.47	.45	.43	.51	.64	.73	
1879	13	4	8	9	11	11	11	11	11	11	11	11	6.8	5.8	5.3	4.3	5.3	5.7	6.0	5.9	5.4	5.7	6.1	6.6	.90	.96	1.00	1.04	.57	.47	.45	.43	.51	.64	.73	
1880	13	4	8	9	11	11	11	11	11	11	11	11	6.8	5.8	5.3	4.3	5.3	5.7	6.0	5.9	5.4	5.7	6.1	6.6	.90	.96	1.00	1.04	.57	.47	.45	.43	.51	.64	.73	
1881	13	4	8	9	11	11	11	11	11	11	11	11	6.8	5.8	5.3	4.3	5.3	5.7	6.0	5.9	5.4	5.7	6.1	6.6	.90	.96	1.00	1.04	.57	.47	.45	.43	.51	.64	.73	
1882	17	20	26	27	27	27	27	27	27	27	27	27	7.8	8.3	7.8	7.5	9.6	7.2	6.8	7.6	8.1	8.3	8.9	8.2	1.00	1.04	1.01	.82	.68	.63	.44	.44	.58	.60	1.29	
1883	17	20	26	27	27	27	27	27	27	27	27	27	7.8	8.3	7.8	7.5	9.6	7.2	6.8	7.6	8.1	8.3	8.9	8.2	1.00	1.04	1.01	.82	.68	.63	.44	.44	.58	.60	1.29	
1884	17	20	26	27	27	27	27	27	27	27	27	27	7.8	8.3	7.8	7.5	9.6	7.2	6.8	7.6	8.1	8.3	8.9	8.2	1.00	1.04	1.01	.82	.68	.63	.44	.44	.58	.60	1.29	
1885	17	20	26	27	27	27	27	27	27	27	27	27	7.8	8.3	7.8	7.5	9.6	7.2	6.8	7.6	8.1	8.3	8.9	8.2	1.00	1.04	1.01	.82	.68	.63	.44	.44	.58	.60	1.29	
1886	17	20	26	27	27	27	27	27	27	27	27	27	7.8	8.3	7.8	7.5	9.6	7.2	6.8	7.6	8.1	8.3	8.9	8.2	1.00	1.04	1.01	.82	.68	.63	.44	.44	.58	.60	1.29	
Cor.	23	18	11	0	12	18	21	20	12	2	11	20	-.6	-.5	-.3	-.2	+.1	+.1	+.5	+.7	+.5	+.3	-.3	-.8	+.81	+.24	1.60	-.53	4.99	7.16	1.34	3.38	1.80	6.80	1.81	3.38

Year.	Mean temperature (degrees).												Clouds (tenths).												Precipitation (inches).													
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.		
1872	33	36	38	43	46	66	76	79	78	76	71	68	48	41	5.3	5.3	5.4	5.0	5.0	4.3	4.8	4.3	4.5	3.6	5.9	6.3	13.00	18.12	30.10	33.83	41.67	27.25	28.84	18.33	23.30	10.99	17.10	24.92
1873	38	39	39	43	44	52	77	78	79	78	76	68	48	45	5.3	5.3	5.4	5.0	5.0	4.3	4.8	4.3	4.5	3.6	5.9	6.3	29.21	18.12	30.10	33.83	41.67	27.25	28.84	18.33	23.30	10.99	17.10	24.92
1874	38	39	39	43	44	52	77	78	79	78	76	68	48	45	5.3	5.3	5.4	5.0	5.0	4.3	4.8	4.3	4.5	3.6	5.9	6.3	29.21	18.12	30.10	33.83	41.67	27.25	28.84	18.33	23.30	10.99	17.10	24.92
1875	42	46	46	53	54	67	74	79	73	67	66	39	45	46	5.3	5.3	5.4	5.0	5.0	4.3	4.8	4.3	4.5	3.6	5.9	6.3	29.21	18.12	30.10	33.83	41.67	27.25	28.84	18.33	23.30	10.99	17.10	24.92
1876	42	46	46	53	54	67	74	79	73	67	66	39	45	46	5.3	5.3	5.4	5.0	5.0	4.3	4.8	4.3	4.5	3.6	5.9	6.3	29.21	18.12	30.10	33.83	41.67	27.25	28.84	18.33	23.30	10.99	17.10	24.92
1877	34	44	44	44	52	77	75	79	77	70	60	45	48	48	5.6	5.2	5.5	5.6	4.7	5.1	4.4	3.6	4.9	5.3	5.5	4.4	18.35	6.99	26.52	39.50	17.47	51.17	28.03	30.01	33.96	34.43	33.87	23.89
1878	34	44	44	44	52	77	75	79	77	70	60	45	48	48	5.6	5.2	5.5	5.6	4.7	5.1	4.4	3.6	4.9	5.3	5.5	4.4	18.35	6.99	26.52	39.50	17.47	51.17	28.03	30.01	33.96	34.43	33.87	23.89
1879	34	44	44	44	52	77	75	79	77	70	60	45	48	48	5.6	5.2	5.5	5.6	4.7	5.1	4.4	3.6	4.9	5.3	5.5	4.4	18.35	6.99	26.52	39.50	17.47	51.17	28.03	30.01	33.96	34.43	33.87	23.89
1880	34	44	44	44	52	77	75	79	77	70	60	45	48	48	5.6	5.2	5.5	5.6	4.7	5.1	4.4	3.6	4.9	5.3	5.5	4.4	18.35	6.99	26.52	39.50	17.47	51.17	28.03	30.01	33.96	34.43	33.87	23.89
1881	34	44	44	44	52	77	75	79	77	70	60	45	48	48	5.6	5.2	5.5	5.6	4.7	5.1	4.4	3.6	4.9	5.3	5.5	4.4	18.35	6.99	26.52	39.50	17.47	51.17	28.03	30.01	33.96	34.43	33.87	23.89
1882	34	44	44	44	52	77	75	79	77	70	60	45	48	48	5.6	5.2	5.5	5.6	4.7	5.1	4.4	3.6	4.9	5.3	5.5	4.4	18.35	6.99	26.52	39.50	17.47	51.17	28.03	30.01	33.96	34.43	33.87	23.89
1883	34	44	44	44	52	77	75	79	77	70	60	45	48	48	5.6	5.2	5.5	5.6	4.7	5.1	4.4	3.6	4.9	5.3	5.5	4.4	18.35	6.99	26.52	39.50	17.47	51.17	28.03	30.01	33.96	34.43	33.87	23.89
1884	34	44	44	44	52	77	75	79	77	70	60	45	48	48	5.6	5.2	5.5	5.6	4.7	5.1	4.4	3.6	4.9	5.3	5.5	4.4	18.35	6.99	26.52	39.50	17.47	51.17	28.03	30.01	33.96	34.43	33.87	23.89
1885	34	44	44	44	52	77	75	79	77	70	60	45	48	48	5.6	5.2	5.5	5.6	4.7	5.1	4.4	3.6	4.9	5.3	5.5	4.4	18.35	6.99	26.52	39.50	17.47	51.17	28.03	30.01	33.96	34.43	33.87	23.89
1886	34	44	44	44	52	77	75	79	77	70	60	45	48	48	5.6	5.2	5.5	5.6	4.7	5.1	4.4	3.6	4.9	5.3	5.5	4.4	18.35	6.99	26.52	39.50	17.47	51.17	28.03	30.01	33.96	34.43	33.87	23.89
Cor.	23	18	11	0	12	18	21	20	12	2	11	20	-.6	-.5	-.3	-.2	+.1	+.1	+.5	+.7	+.5	+.3	-.3	-.8	+.81	+.24	1.60	-.53	4.99	7.16	1.34	3.38	1.80	6.80	1.81	3.38		

TABLE II.—Means of five consecutive months.

Year.	Sun spots.												Magnetic declination.												Range of air pressure (inches)											
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1872	49	45	50	53	51	51	52	53	53	53	56	49	10.0	10.1	10.3	10.4	10.7	11.1	11.1	10.8	10.6	10.3	9.9	9.5	.78	.78	.80	.83	.82	.79	.78	.73	.71	.70	.72	.72
1873	49	45	50	53	51	51	52	53	53	53	56	49	10.0	10.1	10.3	10.4	10.7	11.1	11.1	10.8	10.6	10.3	9.9	9.5	.81	.83	.82	.80	.78	.77	.78	.79	.79	.77	.83	.84
1874	39	39	44	37	33	35	34	37	37	35	39	33	6.3	6.2	5.9	5.9	5.8	5.7	6.0	6.3	6.4	6.7	6.5	6.5	.85	.85	.80	.82	.78	.77	.74	.79	.77	.75	.84	.75
1875	15	11	11	13	19	17	10	7	7	7	7	7	6.3	6.1	5.9	5.9	5.7	6.0	6.3	6.4	6.8	6.6	6.5	6.6	.77	.76	.79	.78	.78	.73	.74	.76	.76	.76	.76	.70
1876	9	9	9	9	6	4	3	3	3	3	3	3	6.8	5.8	5.5	5.3	5.3	5.4	5.6	5.7	5.8	5.5	5.9	6.0	.72	.79	.79	.78	.79	.78	.72	.68	.68	.68	.70	.70
1877	7	8	9	7	6	5	4	3	3	3	3	3	6.8	5.8	5.5	5.3	5.3	5.4	5.6	5.7	5.8	5.5	5.9	6.0	.72	.79	.79	.78	.79	.78	.72	.68	.68	.68	.70	.70
1878	6	6	6	4	3	3	3	3	3	3	3	3	6.8	5.8	5.5	5.3	5.3	5.4	5.6	5.7	5.8	5.5	5.9	6.0	.72	.79	.79	.78	.79	.78	.72	.68	.68	.68	.70	.70
1879	6	6	8	8	10	14	19	21	21	21	26	17	7.6	7.4	7.4	7.8	7.9	8.1	8.6	8.6	8.5	8.5	8.3	8.2	.77	.75	.69	.82	.85	.80	.79	.80	.79	.85	.85	.83
1880	13	23	25	28	31	32	30	36	38	35	25	23	7.6	7.4	7.4	7.8	7.9	8.1	8.6	8.6	8.5	8.5	8.3	8.2	.77	.75	.69	.82	.85	.80	.79	.80	.79	.85	.85	.83
1881	13	23	25	28	31	32	30	36	38	35	25	23	7.6	7.4	7.4	7.8	7.9	8.1	8.6	8.6	8.5	8.5	8.3	8.2	.77	.75	.69	.82	.85	.80	.79	.80	.79	.85	.85	.83
1882	23	31	34	37	36	34	28	25	25	22	21	20	8.0	8.0	8.2	8.1	7.8	7.7	7.9	7.6	7.9	8.2	8.3	.73	.75	.78	.81	.82	.84	.79	.78	.69	.75	.75	.76	.76
1883	17	19	18	23	28	29	27	33	33	31	38	29	8.3	8.1	8.0	8.4	8.4	8.6	8.9	8.8	8.6	8.6	8.0	.87	.87	.81	.82	.84	.82	.79	.79	.80	.77	.77	.77	.77
1884	43	43	43	43	43	43	34	31	29	28	27	20	8.3	8.3	8.4	8.8	8.6	8.4	8.3	8.3	7.8	7.9	8.1	.75	.75	.74	.74	.73	.74	.75	.73	.73	.75	.77	.76	.76
1885	38	38	48	48	48	48	48	48	48	48	33	27	7.3	7.5	6.9	7.2	7.7	8.1	8.4	8.4	8.3	7.6	7.7	.77	.77	.81	.76	.73	.69	.70	.74	.75	.71	.75	.75	.76
1886	30	31	37	35	37	29	27	20	15	9	9	27	7.3	7.5	6.9	7.2	7.7	8.1	8.4	8.4	8.3	7.6	7.7	.77	.77	.81	.76	.73	.69	.70	.74	.75	.71	.75	.75	.76
Cor.	23	18	11	0	12	18	21	20	12	2	11	20	-.6	-.5	-.3	-.2	+.1	+.1	+.5	+.7	+.5	+.3	-.3	-.8	+.81	+.24	1.60	-.53	4.99	7.16	1.34	3.38	1.80	6.80	1.81	3.38

Year.	Mean temperature (degrees.)												Clouds (tenths.)												Precipitation (inches.)											
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1872	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	24.57	25.11	29.40	26.87	28.22	26.86	26.23	22.45	32.21	22.35	24.01	24.69
1873	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1874	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1875	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1876	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1877	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1878	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1879	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1880	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1881	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1882	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1883	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1884	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1885	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
1886	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49
Cor.	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	26.01	31.89	29.39	26.01	28.17	30.24	30.08	26.04	33.95	24.49	23.32	24.49

A careful study of these curves will show many very interesting peculiarities. 1st, There is quite a marked minimum in the sun spot and magnetic declination curves between 1878 and 1879. 2d, The fluctuations in the latter correspond quite closely with those in the former, occurring, however, in many instances, from two to three months later. The enormous increase of sun spots in April, May, June, and July, 1885, has no such marked increase in the magnetic declination, and may be due to a large number of smaller spots having been counted in those months. 3d, There seems to be no close connection between the first two curves and either the range in air pressure or the mean temperature. 4th, There is a slight indication of a diminution of clouds and precipitation during the minimum of the sun spot period, but if there be a direct and important connection it is largely masked by other forces.

In presenting this method of investigation and these almost negative results, it is not intended to assume that the question of a connection or non-connection is by any means settled. It is simply an indication that, in common with nearly all other investigations in this line, this method of attacking the problem gives only negative results. The meteorological elements are affected by so many causes, which serve to mask the real effects from any comical or supra-terrestrial force, that we cannot hope to obtain a satisfactory solution until we are enabled to eliminate all other forces disturbing the one under consideration.

A single example may be given in a possible line of investigation. It is evident that taking a monthly mean of any element will frequently smooth out the very effect we wish to study. Now, taking the temperature, it would seem that a daily curve of this element, when compared with the daily sun spot curve, might show a connection which could not otherwise be obtained, but before such comparison could be made it would be essential to examine the influence of day and night, high and low pressure, invisible vapor in the atmosphere, clouds, precipitation, etc. It is evident that clouds would have contrary effects at night and in the daytime; in the first case they would tend to increase the temperature, and in the latter to diminish it.

The whole problem is much more complicated than appears at first sight. Incidentally, several very interesting points are brought out by the last three curves. 1st, With very few exceptions the winters of odd years are relatively cold, and those of even years are warm. 2d, In general the warm months have the least clouds and the cool months the most. 3d, As was to be expected, the curves of cloudiness and precipitation are very similar.

RESULTS OF ANEMOMETER OBSERVATIONS AT SEA.

[By Prof. FRANK WALDO.]

On a voyage from Baltimore, United States, to Bremerhaven, Germany, from September 28th to October 15th, 1882, on board the steamship "Ohio," three anemometers were exposed—No. 527 on cross piece of the mainmast, about eighty feet above the water; No. 519 just over the front edge, and on the top of the awning frame of the bridge, about thirty-five feet above the water; No. 521 on the wheel-house, near the stern, about twenty-seven feet above the water. The anemometers were of the Robinson form, with cups 4 inches (101.6 mm.) in diameter and arms 6.72 inches (170.7 mm.). These are the dimensions of the standard instrument of the Signal Service. The anemometer on the bridge blew off early in the series of observations and was rendered unserviceable. The few readings of use in showing results of the exposures. The instruments had all been compared with the Signal Service standard, from which they did not differ more than four per cent. They were apparently new and in perfect condition at the time of mounting on ship-board, and, with the exception noted, remained in good condition as long as they were in use.

Analysis of the problem.

We observe: 1st, the true direction of the ship's course; 2d, the motion of the ship in an hour; 3d, the estimated true direction of approach of the wind; 4th, the anemometer reading for the hour; this is the resultant effect of the velocity of the wind and of the steamer. Required the *true velocity* of the wind for the hour.

To avoid onerous calculation I have devised a graphical method of solving the triangle between the ship and the wind, as follows:

Lay off on a line on a convenient scale 0, 1, 2, 3, &c., parts which correspond to the anemometer reading. Lay off another line, beginning at 0 and forming an angle of 1 point ($11\frac{1}{4}^\circ$) with this first line. On the second line mark off spaces 0, 1, 2, 3,.....16, 17, 18, corresponding to knots (sea miles); these to be on the same actual scale as the divisions of the first line. Then through the points 1, 2, 3,.....16, 17, 18 draw lines parallel to the first line drawn. There will be 18 of these lines.

The same is done for angles 2 points, 3 points, &c. Take a pair of dividers and use, as follows: We have given the anemometer reading, the space passed over by the steamer, and the angle, expressed in points, between the true wind direction and the ship's course. Select the sheet on which the lines are at the correct angle. Adjust the dividers to the number of miles recorded for

the hour by the anemometer, by means of the first line above. Then place one leg of the dividers at the intersection of the two original lines. Sweep with the other leg until the free end falls on the parallel line drawn through the divisions corresponding to the space passed over by the ship in the hour. Let the free leg rest on this intersection and, by readjusting the dividers, let the other leg touch the end of the same parallel line, where it intersects the second line, drawn at the division which marks the space passed over by the ship. Take up the dividers unchanged and find how many miles on the first line drawn correspond to the distance between the points of the dividers. This distance is the true wind movement for the hour.

Table I shows: 1st, the wind estimated on the Beaufort scale, 0-12; 2d, the number of hours for each anemometer corresponding to the wind velocity in the first column; 3d, the reduced mean anemometer indication for the same time (true wind velocity):

TABLE I.

Beaufort scale.	Hours.				Anemometer.			
	M.	M.	W.	H.	M.	M.	W.	H.
1.0.....	3	3	4	2.5	6.3	14	1	
1.5.....	3	3	4	11.6	9.3	18.8		
2.0.....	15	21	1	12.3	13.1	18.7		
2.5.....								
3.0.....	7	12	1	13.4	10.0	23.9		
3.5.....			1			19.5		
4.0.....	19	24		14.1	16.4			
4.5.....	1	1	1	23.1	22.3	19.1		
5.0.....	21	18		19.9	19.4			
5.5.....	37	36	18	27.5	30.5	29.2		
6.0.....	37	34	4	27.2	32.6	26.8		
6.5.....	19	11		24.1	37.7			
7.0.....	12	8	4	28.4	39.3	35.9		
7.5.....	5	3	2	32.4	40.5	30.6		
8.0.....	5	3	1	46.2	43.7	43.4		
8.5.....	5	4	2	47.2	44.7	33.9		
9.0.....	5	2	2	51.8	42.8	46.8		

From Table I, by a graphical construction, we obtain, approximately, the wind velocity corresponding to each figure of the Beaufort scale at each exposure, as in Table II:

TABLE II.

1	2	3	4	5	6	7	8	9	Beaufort scale.
6	12	15	17	20	27	30	42	54	Mainmast (80 feet).
7	10	13	17	23	32	40	43	47	Wheel-house (27 feet).
12	18	22	25	28	30	32	37	43	Bridge (35 feet).

Table III gives a comparison between these results and those of Prof. R. H. Scott, in England (Quarterly Journal Meteorological Society, Vol. II, p. 109). Column five is formed from Table II, by taking the mean of the three anemometers, giving a weight of 1 to the bridge and weights of 3 to the other two to allow for the number of observations:

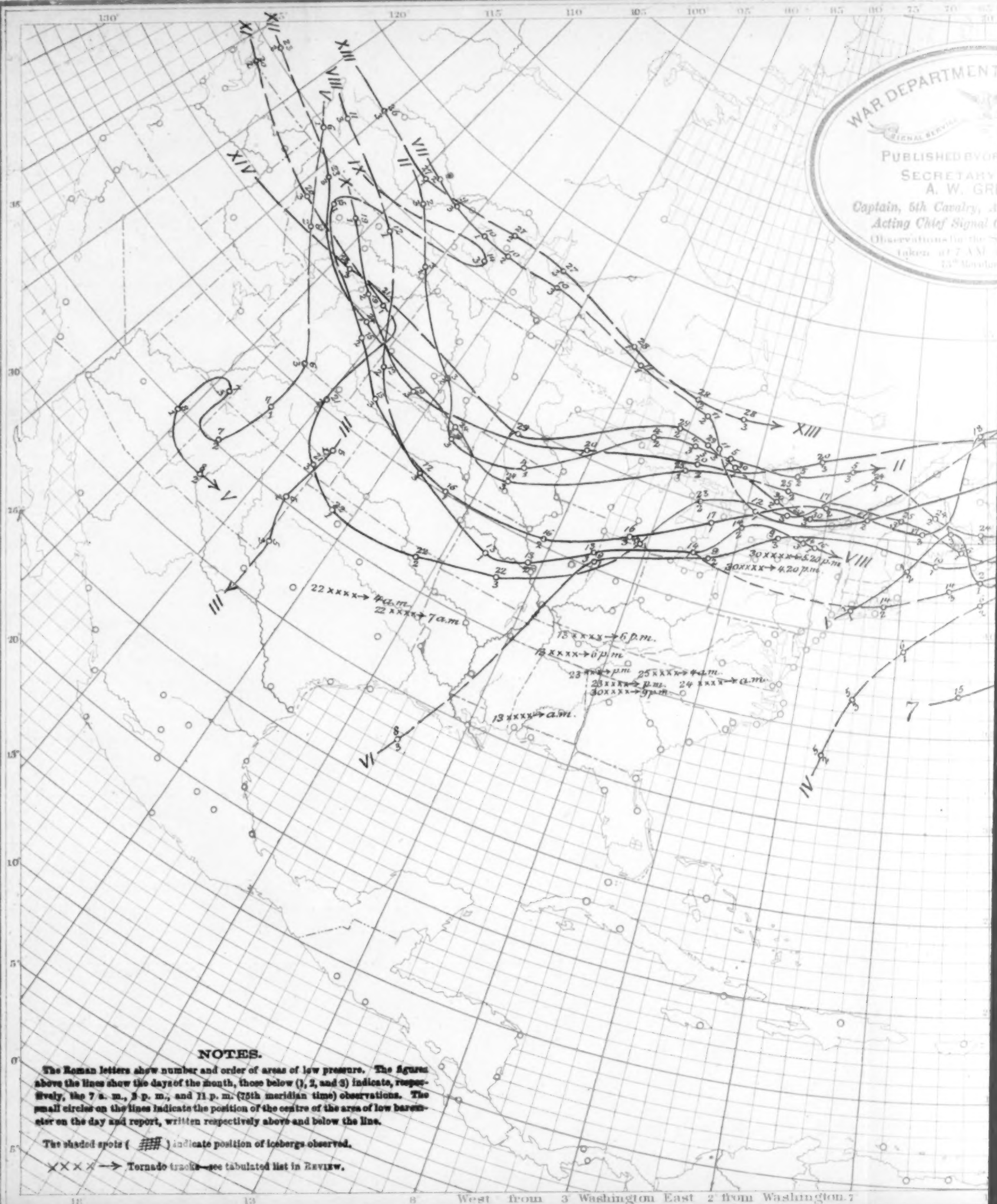
TABLE III.

Beaufort scale.	R. H. Scott.	F. Waldo.			Mean of three anemometers.
		W.	H.	M.	
1.....	8	7	6	7	
2.....	13	10	12	12	
3.....	18	13	15	15	
4.....	23	17	17	18	
5.....	28	23	20	22	
6.....	34	32	27	30	
7.....	40	40	30	35	
8.....	48	43	42	42	
9.....	56	47	54	50	

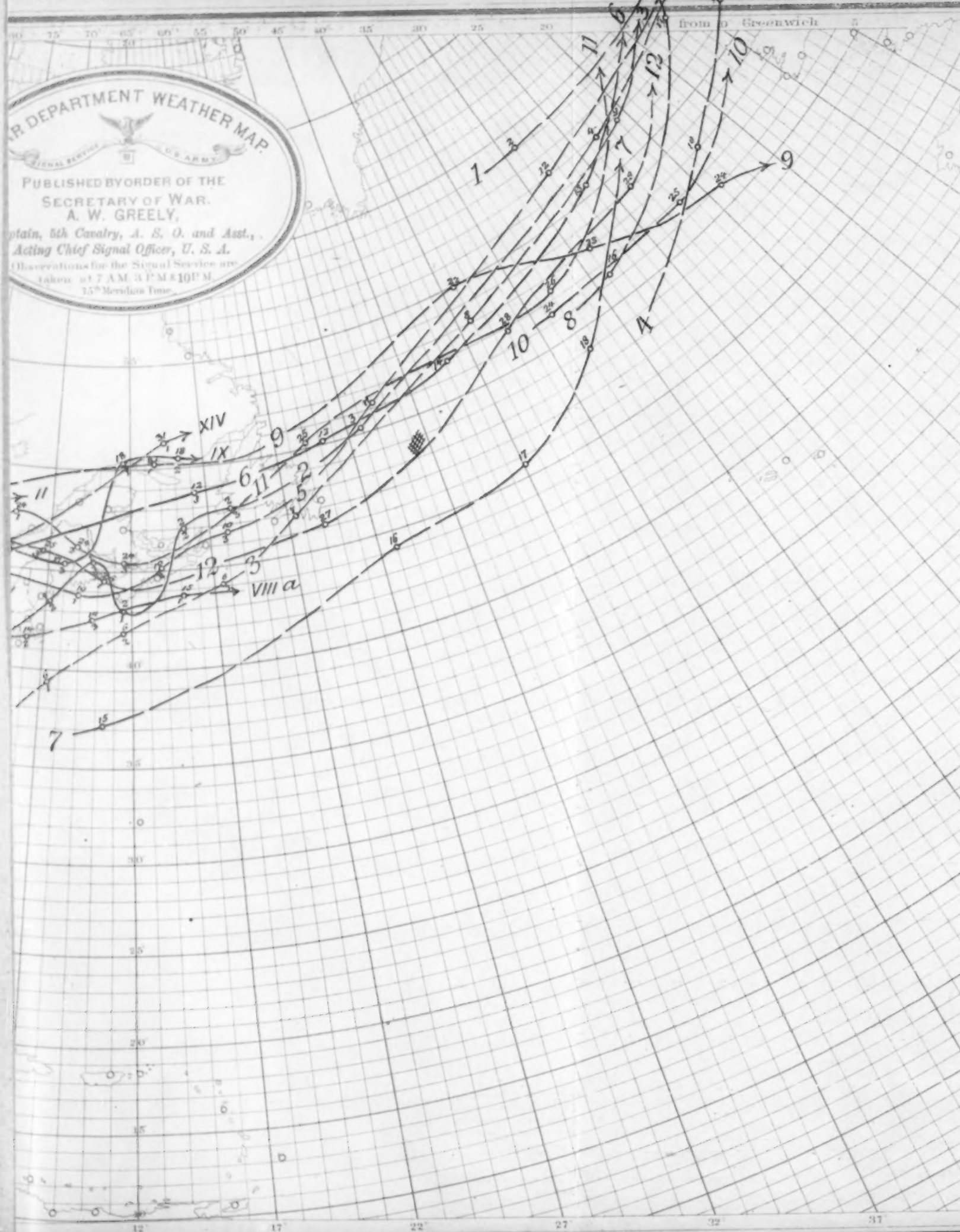
Comparing the results at twenty-seven and eighty feet, we find that up to 17 miles per hour there seems little difference, but from 17 to 42 the lower instrument gave the higher readings, and above 42 the upper gave the higher reading. No record of hoisting the mainsail was kept, and this sail, though small, might have deflected the wind, causing smaller readings on the mainmast.

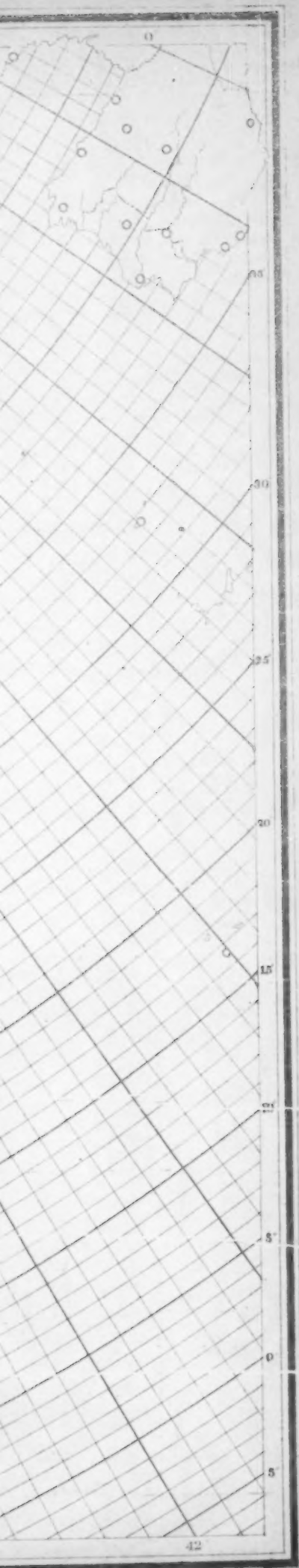
Chart I. Tracks of Areas of Low

Form 106 G 1884.



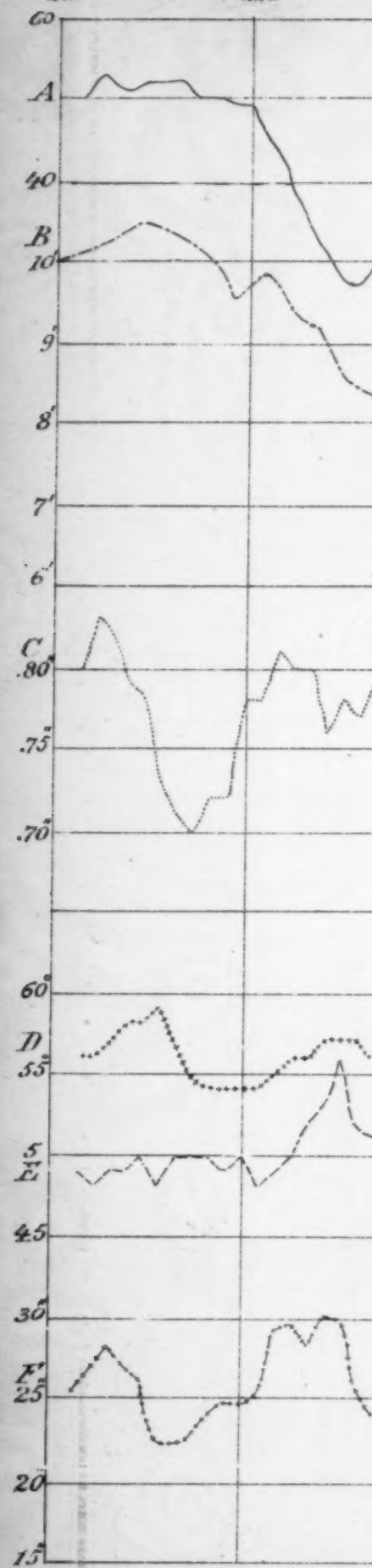
of Areas of Low Pressure. January, 1887.





Jan
1872

Jan
1875



A ————— Sun
B - - - - - Magne
C Range

SUN SPOTS AND METEOROLOGICAL

Jan.
1874

Jan.
1875

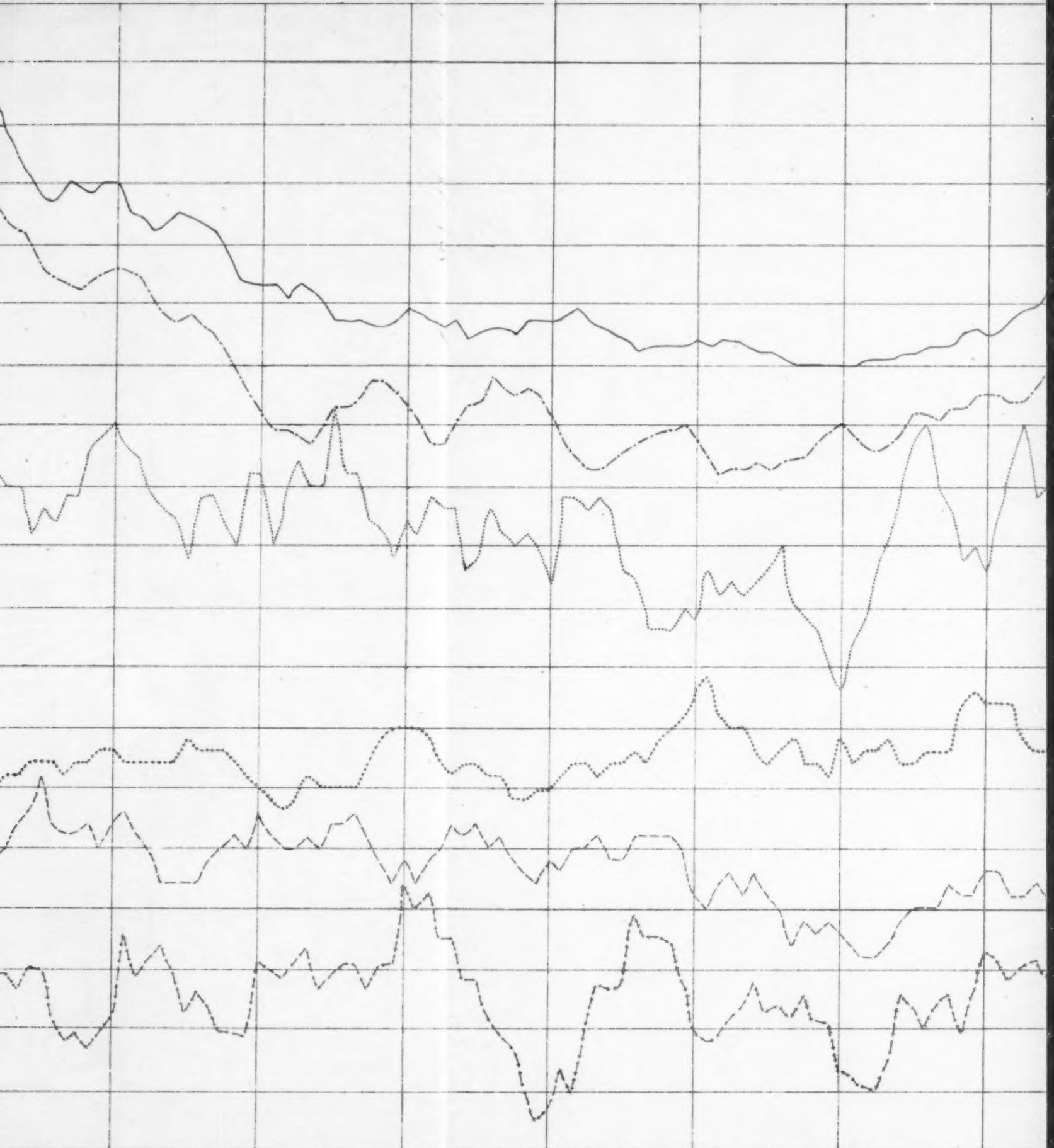
Jan.
1876

Jan.
1877

Jan.
1878

Jan.
1879

Jan.
1880



Sun Spots. D *Mean temperature.*
Magnetic declination. E *Mean cloudiness.*
Range of air pressure. F *Mean precipitation.*

LOGICAL PHENOMENA.

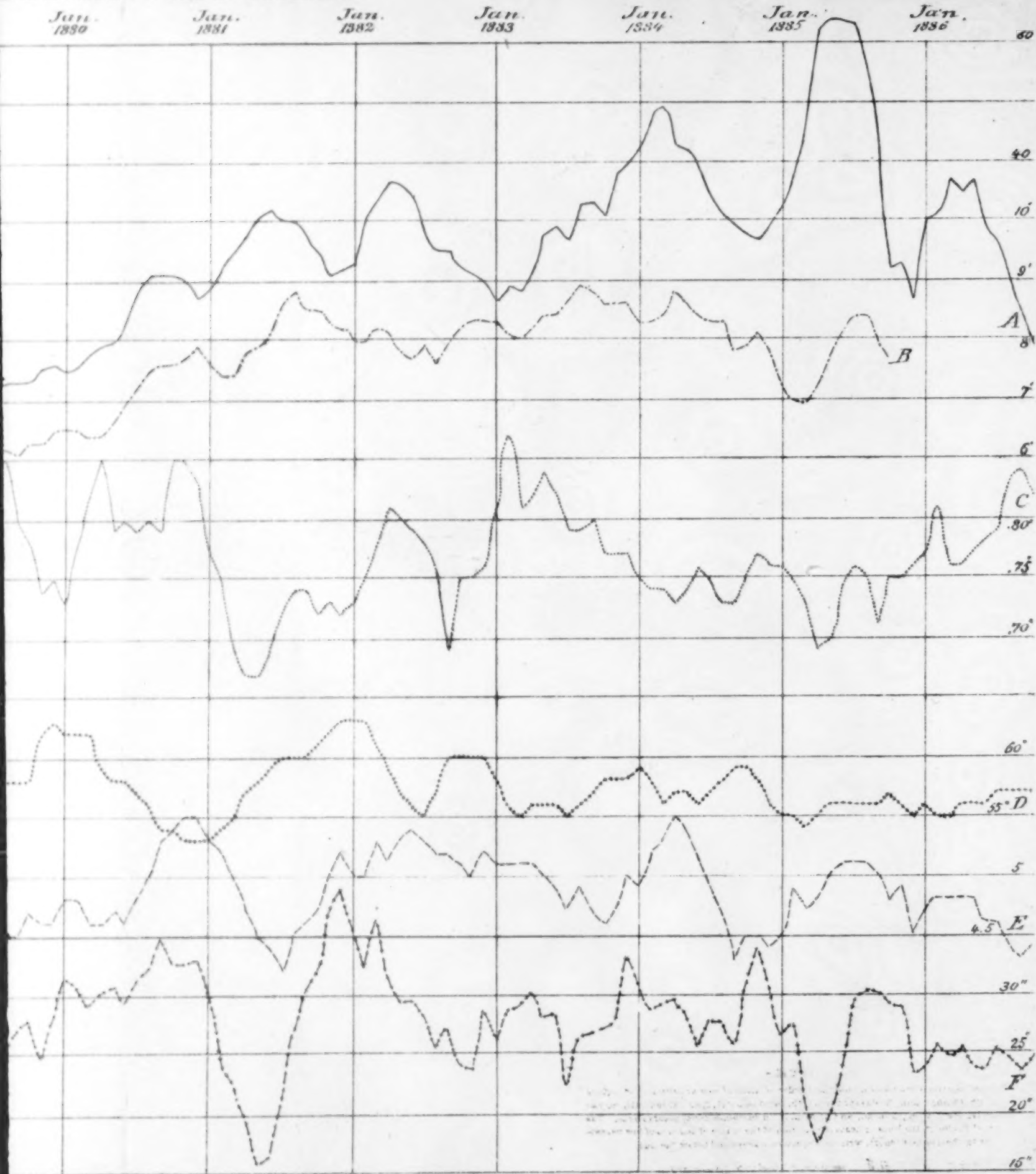
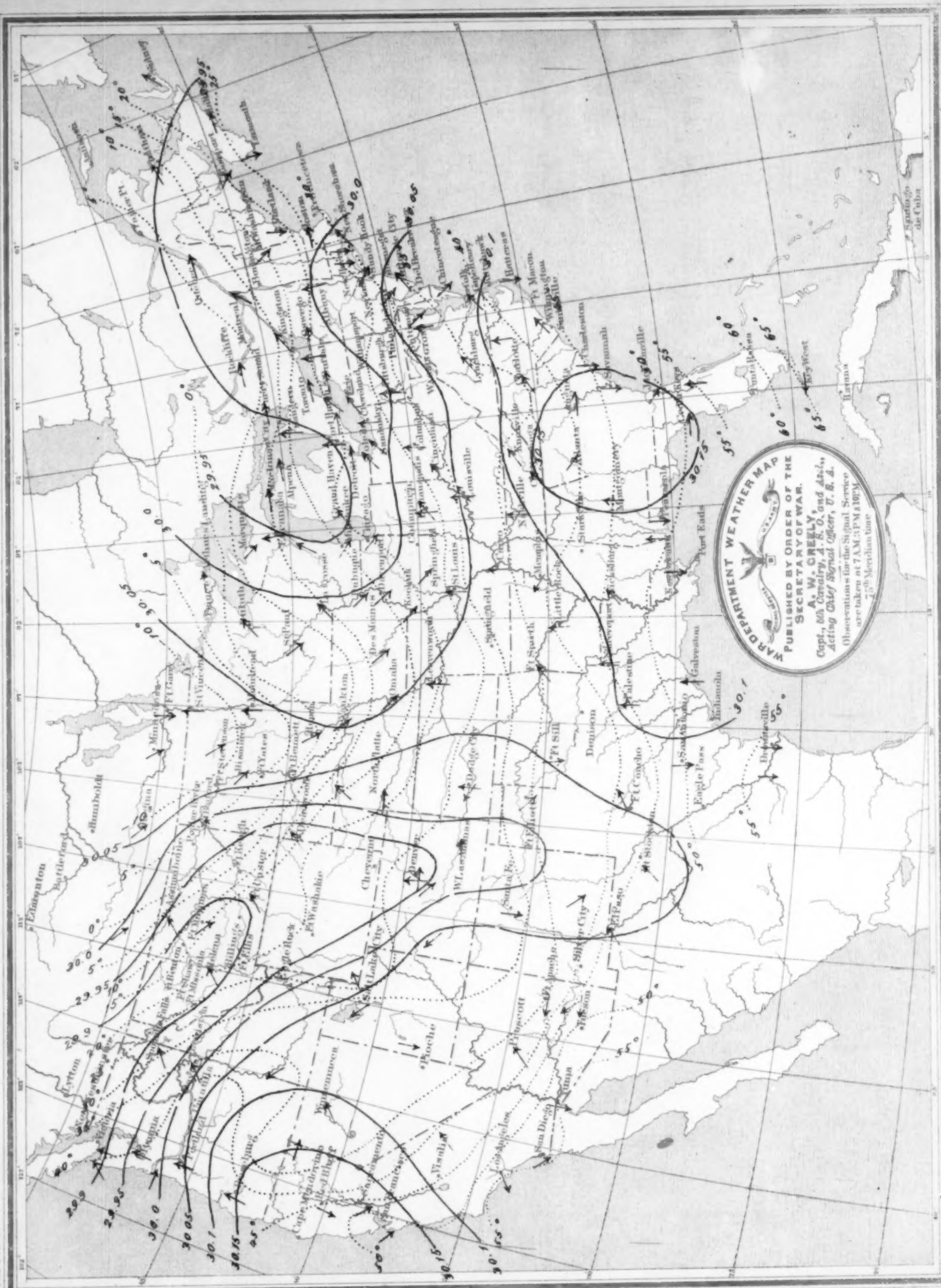


Chart II. Isobars, Isotherms, and Winds. January 1887.

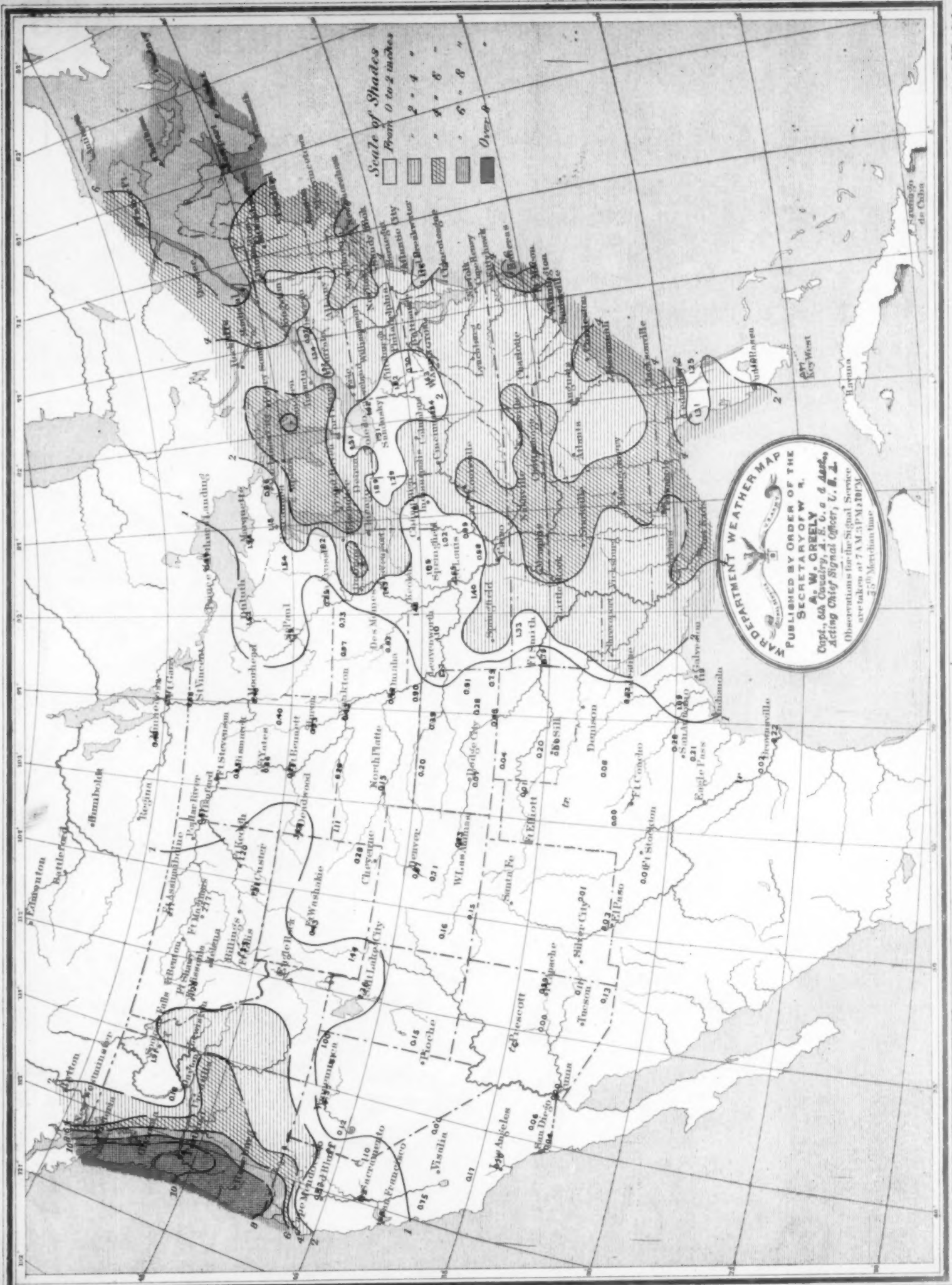


THE JOURNAL OF ADAM SMITH, 1776-1790



Chart III. Precipitation, January, 1887.

Form 106 F

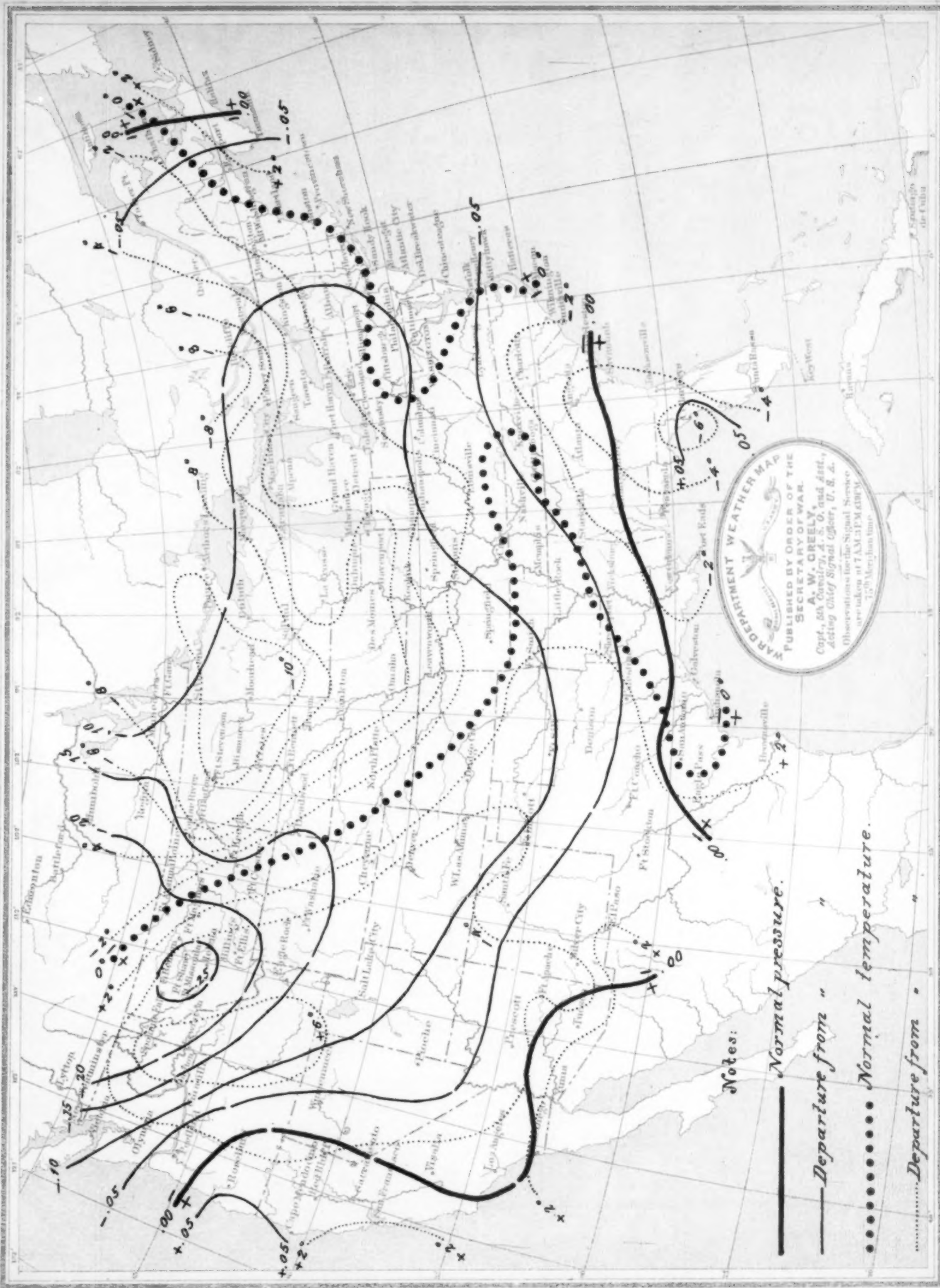


Signal Office Left



Chart IV. Departures from Normal Atmospheric Pressure and Temperature. January, 1887.

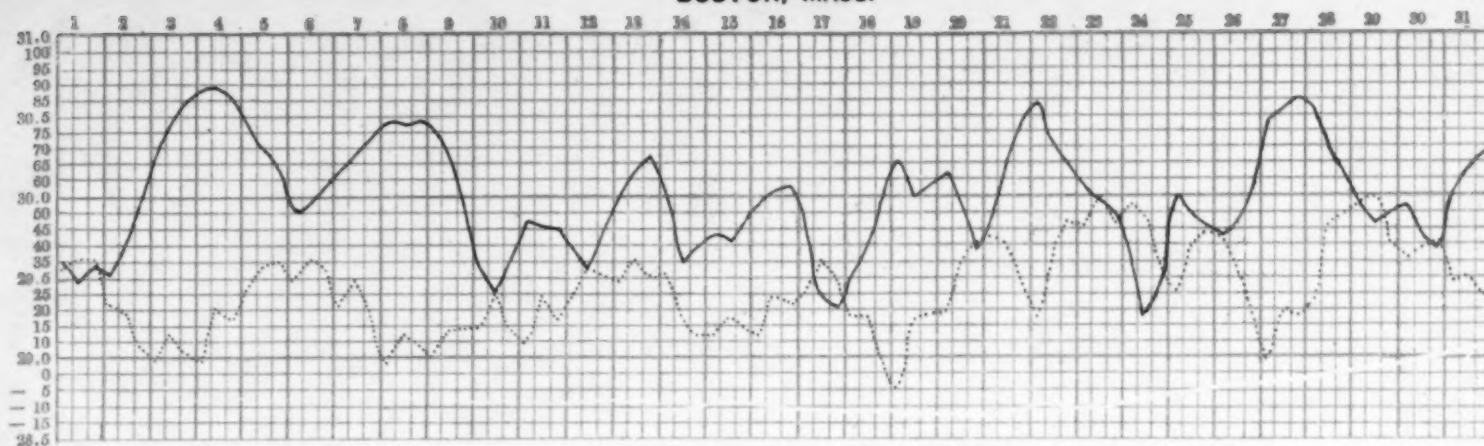
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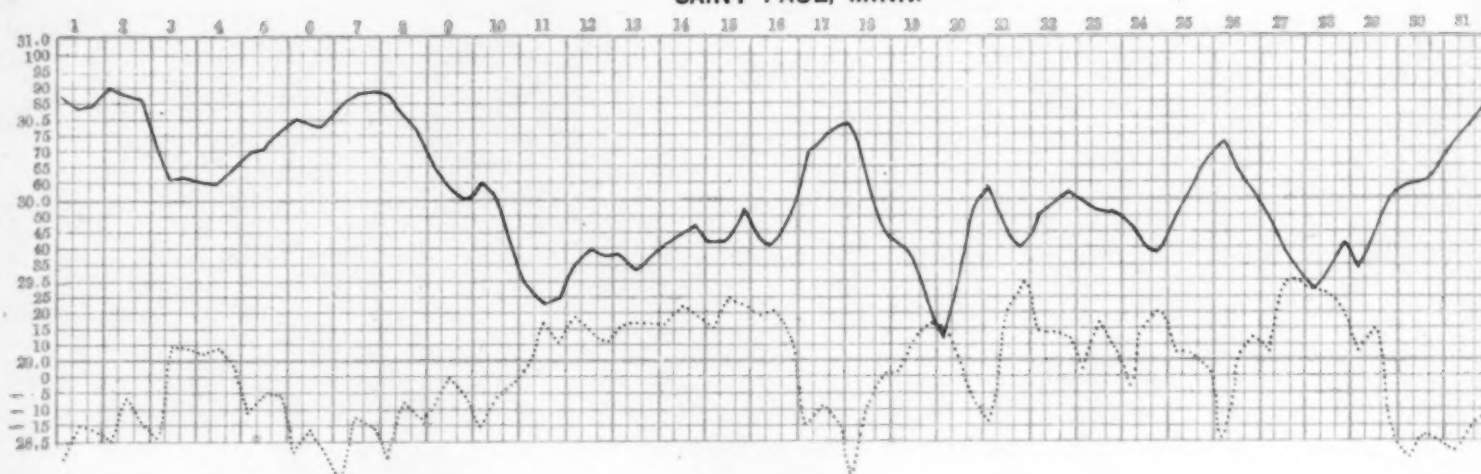
W. DEPARTMENT WEATHER MAP
 PUBLISHED BY ORDER OF THE
 SECRETARY OF WAR.
 Capt. A. W. GREELY,
 Acting Chief Signal Officer, U. S. A.
 Observations for the Signal Service
 are taken at 7 A.M. and 1 P.M.

Chart V. Pressure (——) and Temperature (.....) Curves. January, 1887.

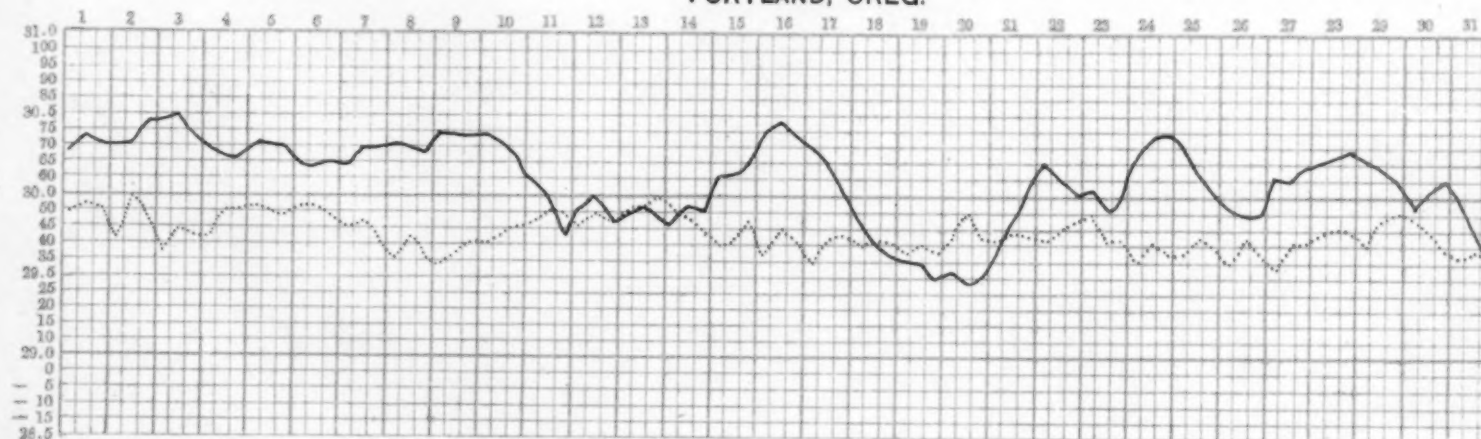
BOSTON, MASS.



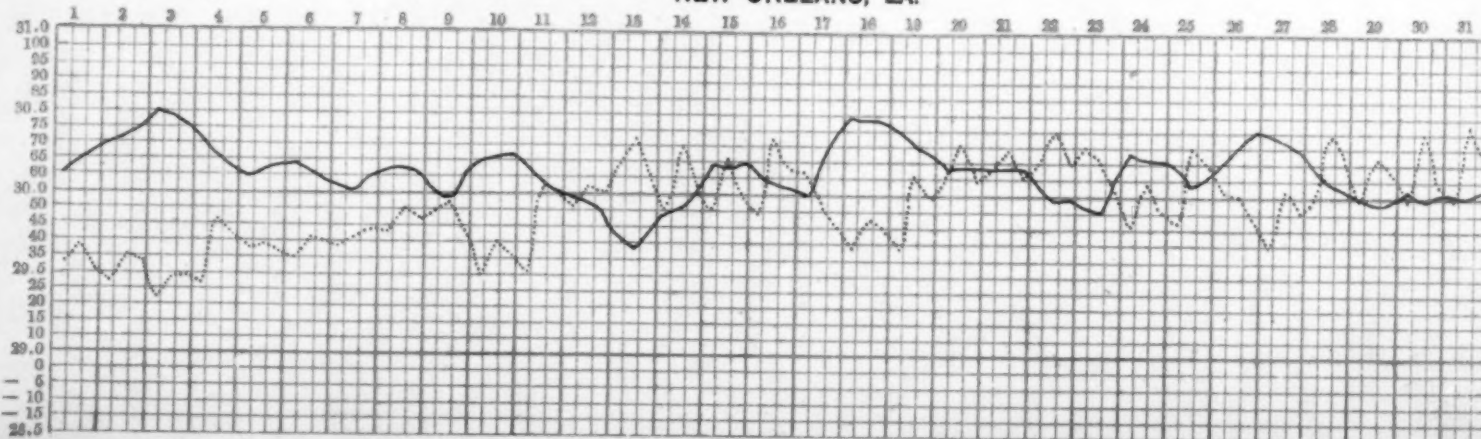
SAINT PAUL, MINN.



PORTLAND, OREG.



NEW ORLEANS, LA.



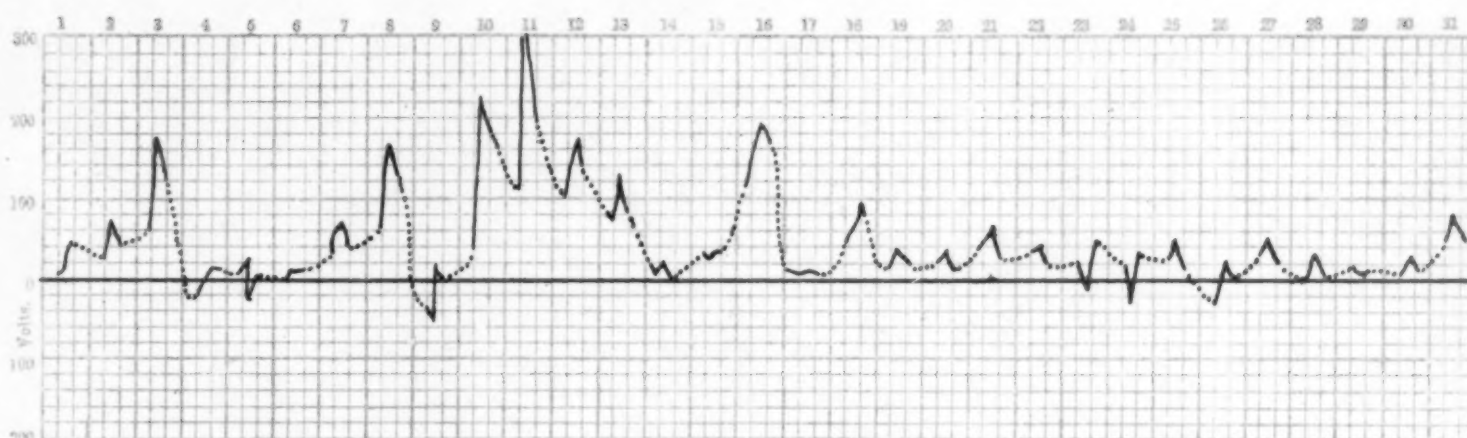
THE UNIVERSITY OF CHICAGO
LIBRARY

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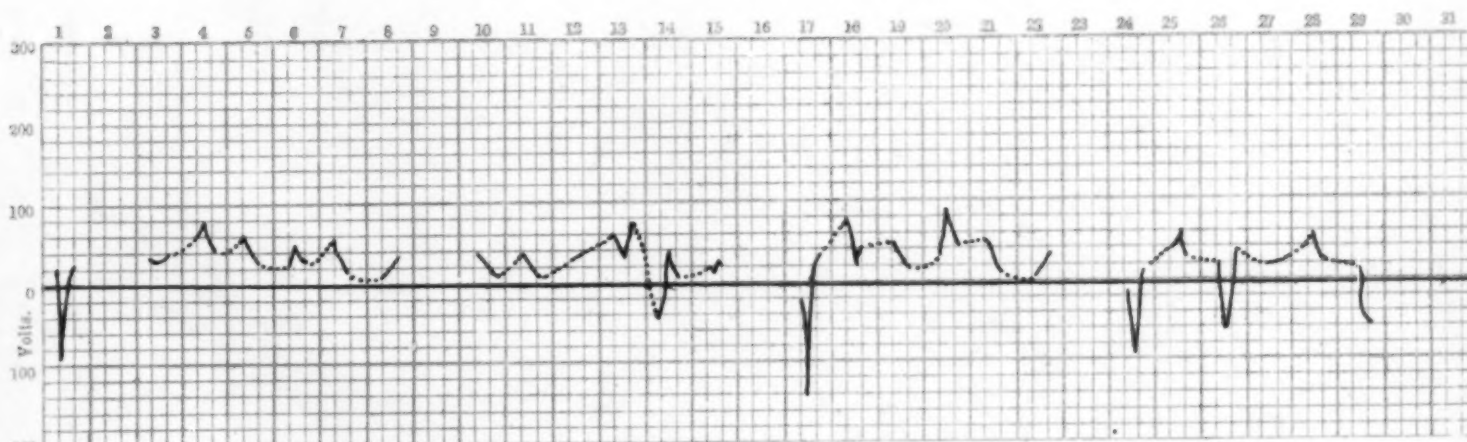
Chart VI. Curves showing Electrometer Readings.



Washington, D. C., January, 1887.



Boston, Mass., January, 1887.



New Haven, Conn., January, 1887.



Ithaca, N. Y., January, 1887.

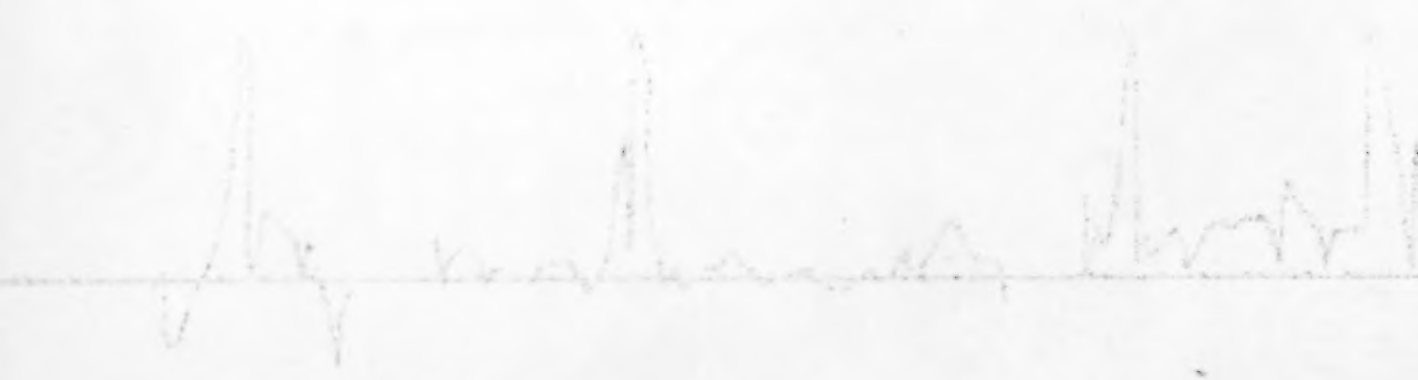


Chart VII. Annual Mean Temperature, 1886, and Departures from Normal.

Form 106 F.

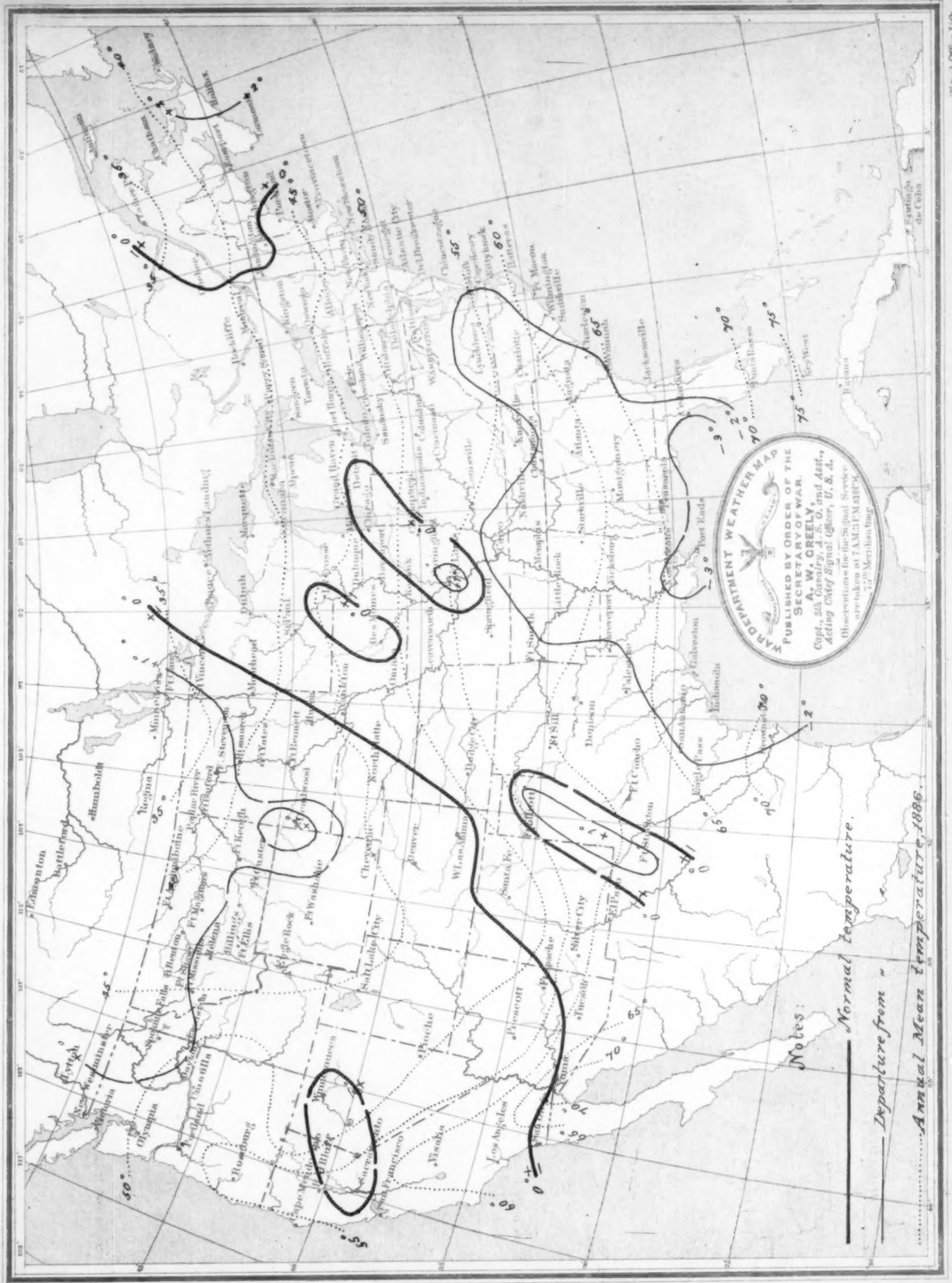
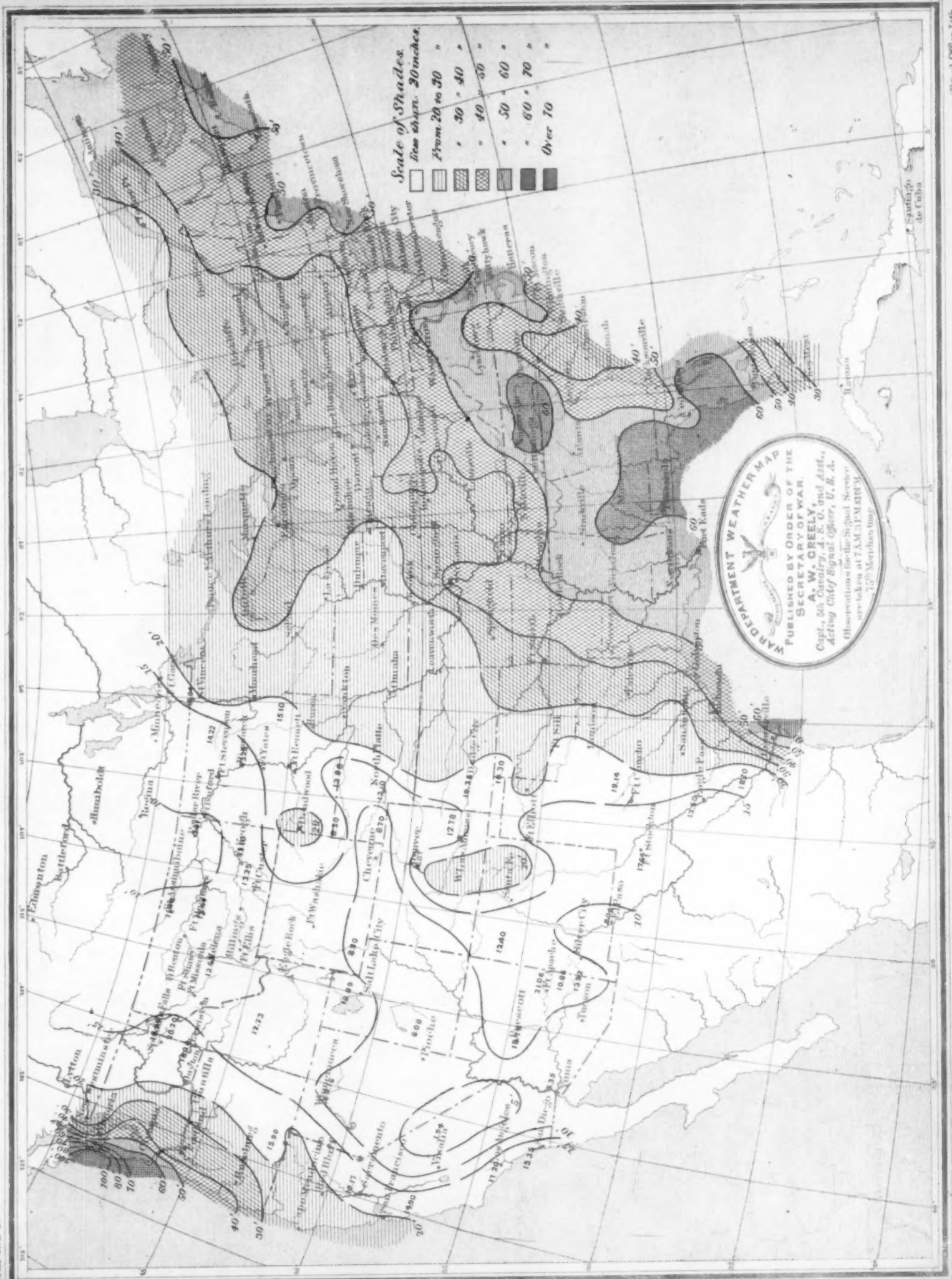


Chart VIII. Annual Precipitation.

Form 106 F.



Observer and place of observation.	Observer and place of observation.	Observer and place of observation.	Observer and place of observation.
Alexander, S., Birmingham, Mich.	Dogier, Wm., Mattoon, Ill.	Knapp, J. G., Limona, Pa.	Selta, Chas., De Soto, Nebr.
Anderson, Dr. W. W., Stateburg, S. C.	Dawhurst, Rev. E., Voluntown, Conn.	Keith, J. C., College City, Cal.	Shriver, E. T., Cumberland, Md.
Altner, J. M., Independence, Kans.	Day, Theodore, Dyberry, Pa.	Keese, G. Pomeroy, Cooperstown, N. Y.	Shepard, E. M., Springfield, Mo.
Adams, Dr. O. H., Vinceland, N. J.	Ellsworth, W. W., Hartford, Conn.	Kuhne, F. W., Fort Wayne, Ind.	Seicheur, Rob't Lewiston, Idaho.
Abbott, Dr. E. K., Salinas, Cal.	Ellison, W. A., Stateville, N. C.	Lincoln, A. T., Marion, Va.	Shriver, Howard, Wytheville, Va.
Arents, Hiram, Oroville, Cal.	Ellis, John, Marquette, Nebr.	Ladshaw, G. E., Paolet, S. C.	Scott, Thos. G., Forsyth, Ga.
Adams, A. H., Fort Meade, Fla.	Ewell, Dr. M. D., South Evanston, Ill.	Lueps, Miss Anna, Mantowoc, Wis.	Smith, Prof. T. B., Fayette, Mo.
Avey, O. H., Oskaloosa, Iowa.	Eckstein, Rev. M., Conception, Mo.	Loomis, J. C., Jeffersonville, Ind.	Silvius, Urius O., Franklin, Wis.
Beans, Thos. J., Moorestown, N. J.	Ford, H. C., El Dorado, Kans.	Luther, S. M., Garrettsville, Ohio.	Stucky, Dr. C. T., Helvetia, W. Va.
Bryant, A. F., Yutan, Neb.	Fouch, Dr. A., Anderson, Cal.	Loud, Prof. F. H., Colorado Springs, Colo.	Slade, Elisha, Somerset, Mass.
Bentley, David, Princeton, Cal.	Ferris, B. F., Sunman, Ind.	Lorch & Rice, Bethlehem, Pa.	Sonedecker, Rev. T. H., Tiffin, Ohio.
Boerner, Prof. Chas. G., Vevay, Ind.	Friend, Chas. W., Carson City, Nev.	Louder, B. T., Clarksburg, W. Va.	Smith, John R., North Truro, Mass.
Blochman, L. E., Santa Maria, Cal.	Ferguson, Wm., Paterson, N. J.	McDonogh Institute, McDonogh, Md.	Sim, J. R., Summit, Va.
Bayerly, J. F., Spartanburg, S. C.	Ferrill, B. P., Duke, Fla.	Morgan, L. Ray, Philadelphia, Pa.	Scribner, H. F. J., Stratford, Vt.
Ballou, Dr. N. E., Sandwich, Ill.	Frear, Wm., State College, Pa.	Marshall, Gregory, Cresco, Iowa.	Strong, S. B., Setauket, N. Y.
Bennett, Geo., Bandon, Oreg.	Fernald, Prof. M. C., Orono, Me.	McClave, A. J., Benton Harbor, Mich.	Strong, W. C., Kent's Hill, Me.
Bell, Joseph, Franklin, Pa.	Fleming, John, Readington, N. J.	Massachusetts Agricultural Experimental Station, Amherst, Mass.	Samostz, Oscar, Austin, Tex.
Beecher, Chas., Wysox, Pa.	Fuller, Edw. N., Tacoma, Wash. T.	McCready, Miss L. A., Fort Madison, Iowa.	Smith, George F., New Midway, Md.
Baker, Dr. Henry B., Lansing, Mich.	Featherston, Wm., Globe, Kans.		Standenmayer, Dr. L. R., Lincoln, N. C.
Beall, Dr. R. L., Lenoir, N. C.	Field, T. G., Parkersburg, W. Va.		Swezey, Prof. G. D., Crete, Nebr.
Brendel, Dr. Fred., Peoria, Ill.	Gibson, J. H., Salina, Kans.		Trembly, Dr. J. B., Oakland, Cal.
Bartlett, E. B., Vermillion, N. Y.	Gore, Prof. J. W., Chapel Hill, N. C.		Tillinghast, C. B., Albany, N. Y.
Briggs, John, Albany, Oreg.	Granville, John, East Saginaw, Mich.		Tilford, C. M., Mount Blanco, Tex.
Betta, Prof. Arthur, Webster, Dak.	Gates, W. B., Burlington, Vt.		Teale, Rev. A. K., Blue Hill, Mass.
Broad, J. E., Embarras, Wis.	Graves, A. B., Belleville, Kans.		Truman, Geo. S., Genoa, Nebr.
Baldwin, A. L., Bethel, Conn.	Gillingham, Milnor, Fallsington, Pa.		Turnbo, Silas C., Pro Tem, Mo.
Boles, Lieut. A. H., Hudson, Mich.	Gordon, Dr. G. G., Swartz Creek, Mich.		Terborg, Rev. J. E., Pekin, Ill.
Broberg, Mrs. Mary W., Manatee, Fla.	Gowey, H. D., North Lewisburg, Ohio.		Thompson, R. J., Tiffin, Ohio.
Black, W. H., Kalamazoo, Mich.	Green, Dr. Jesse C., West Chester, Pa.		Van Gieson, F. L., Upper Montclair, N. J.
Blachly, C. P., Manhattan, Kans.	Gerrish, S. H., Sacramento, Cal.		Vall, H. D., Santa Barbara, Cal.
Bridges, Q. A., Berlin Mills, N. H.	Geddings, Dr. W. H., Aiken, S. C.		Voegeli, Adolphus, Des Moines, Iowa.
Bowman, Peter, Ruggles, Ohio.	Gray, J. W., Stockham, Nebr.		Went, E. C., Frankfort, Ky.
Boyd, Joseph, Oskaloosa, Iowa.	Goodwin, Wm., North Colebrook, Conn.		Washburn Observatory, Madison, Wis.
Calhoun, P. B., Austin, Tenn.	Goodspeed, Chas. W., Elyria, Ohio.		Wild, Rev. E. P., Newport, Vt.
Cook, S. A., Milledgeville, Ga.	Garlick, Rev. Dr. J. R., Brimington, Va.		Williams, Rev. C. F., Ashwood, Tenn.
Carrington, O. D., Brownville, Nebr.	Gray, Capt. A. W., Kenewick, Wash. T.		Wing, Miss M. E., Charlotte, Vt.
Clark, A. C., Wausau, Wis.	Grathwohl, John, Blooming Grove, Pa.		West, Silas, Cornish, Me.
Charbonnier, Prof. L. H., Athens, Ga.	Heath, E. R., Wyandotte, Kans.		Wylie, Wm., Mount Forest, Canada.
Casey, Geo., Auburn, N. Y.	Harvard College Observatory, Cambridge, Mass.		Wait, S. E., Traverse City, Mich.
Crawford, E. A., Liberty Hill, La.	Hammitt, John W., College Hill, Ohio.		Woodstock College, Woodstock, Md.
Curtis, G. G., Fallston, Md.	Harris, T. C., Raleigh, N. C.		Wells, Rev. Chas. L., Gardiner, Me.
Cornell University, Ithaca, N. Y.	Heaton, Isaac E., Fremont, Nebr.		Williams College Observatory, Williamstown, Mass.
Cutting, Dr. Hiram A., Lumburg, Vt.	Hoskinson, R. M., Blakely, Wash. T.		Wolfe, John H., Wellington, Kans.
Cutler, J. L., Quitman, Ga.	Holt, A. K., Riverside, Cal.		Wulfke, E. F., Independence, Iowa.
Crosier, Adam, Laconia, Ind.	Hodge, Rev. F. B., Wilkesbarre, Pa.		Wearmouth, James, University of Virginia, Va.
Clark, F. A., Weldon, N. C.	Hutchison, L. H., Huntington, W. Va.		
Childs, W. H., Brattleborough, Vt.	Hyde, G. A., Cleveland, Ohio.		
Cass, John J., Allison, Kans.	Haywood, John, Westerville, Ohio.		
Coulthurst, J. E., Dallas, Tex.	Hartzler, J. A., Mottville, Mich.		
Collie, G. L., Delevan, Wis.	Hole, Joseph, Butlerville, Ind.		
Cotton, Dr. D. B., Portsmouth, Ohio.	Humphrey, Dr. J., Fairburg, Neb.		
Cheney, Wm., Minneapolis, Minn.	Held, Rev. F. B., Mount Angel, Oreg.		
Charlton, Prof. Orlando C., Ottawa, K's	Heutwile, L. J., Dale Enterprise, Va.		
Carter, Rev. Dr. W. H., Tallahassee, Fla.	Hamilton, W. H., Corsicana, Tex.		
Cummings, L. D., Palmyra, N. Y.	Hatch, A. H., Windsor, Ill.		
Chubb, Thos. H., Post Mills, Vt.	Harris, W. C., Dover, N. J.		
Cochran, Wm. P., Wakefield, Kans.	Hall, J. B., Worcester, Mass.		
Chase, Dr. Milton, Otsego, Mich.	Hutchison, J. C., Monmouth, Ill.		
Cole, Seward, Cahuenga, Cal.	Hunter, Dr. T. C., Napoleon, Ohio.		
Colton, Prof. G. H., Hiram, Ohio.	Hall, Chas. C., Dudley, Mass.		
Chandler, Dr. W. J., South Orange, N. J.	Hewitt, S. F. H., Middlebrook, W. Va.		
Cass, W. Earle, Roseland, N. J.	Hurlin, Rev. Wm., Antrim, N. H.		
Crump, M. H., Bowling Green, Ky.	Helm, Thos. B., Logansport, Ind.		
Cowgill, Prof. E. B., Manhattan, Kans.	Heacock, J. L., Quakertown, Pa.		
Comstock, Prof. F. M., LeRoy, N. Y.	Hazen, Rev. A., Deerfield, Mass.		
Collin, Prof. Alonzo, Mt. Vernon, Iowa.	Harper, E. G., Harper's Ferry, Ky.		
Dow, Roswell, Sycamore, Ill.	Hasenstab, Philip J., Jacksonville, Ill.		
Davis, Prof. S. M., York, Pa.	Ireland, W. H., Rappahannock, Va.		
Demuse, D. W., Hanging Dog, N. C.	James, John W., Marengo, Ill.		
Davis, W. O., Bloomington, Ill.	Jones, Dr. E. U., Taunton, Mass.		
Dudley, Chas. B., Altoona, Pa.	Jackson Company, Nashua, N. H.		
Dunlap, W. L., Tecumseh, Nebr.	Jordan, Dr. M. D. L., Milan, Tenn.		
Dazey, J. B., Charleston, Ill.	Kirkwood, E., Maury, Ind.		
Deming, H. D., Wellsborough, Pa.			

Military posts from which meteorological reports were received, through the Surgeon General of the Army, in time to be used in the preparation of the Monthly Weather Review for January, 1887.

Alcatraz Island, Cal.	Columbus, Ft. N. Y. H. Lewis, Fort, Colo.	Mount Vernon B'ks, Ala.	Riley, Fort, Kans.	Totten, Fort, Dak.
Angel Island, Cal.	Camp Sheridan, Wyo.	Meade, Fort, Dak.	Snelling, Fort, Minn.	Townsend, Ft., Wash. T.
A. Lincoln, Fort, Dak.	Gaston, Fort, Cal.	McIntosh, Fort, Tex.	Saint Augustine, Fort, Fla.	Union, Fort, N. Mex.
Bayard, Fort, New Mex.	Gibson, Fort, Ind. T.	Missoula, Fort, Mont.	Sisseton, Fort, Dak.	Washakie, Fort, Wyo.
Benicia Barracks, Cal.	Hays, Fort, Kans.	Mason, Fort, Cal.	Shaw, Fort, Mont.	West Point Military Academy, N. Y.
Bidwell, Fort, Cal.	Humphreys, Fort, Ariz.	McDermitt, Fort, Nev.	Selden, Fort, Nebr.	Walla Walla, Ft., Wash. T.
Brady, Fort, Mich.	Klamath, Fort, Oreg.	McDowell, Fort, Ariz.	Supply, Fort, Ind. T.	Wingate, Fort, N. Mex.
Boisé Barracks, Idaho.	Keogh, Fort, Mont.	Monroe, Fort, Va.	Spokane Fort, Wash. T.	Yates, Fort, Dak.
Coeur d'Alene, Ft., Idaho.	Lowell, Fort, Ariz.	Madison Barracks, N. Y.	Sidney, Fort, Nebr.	
Concho, Fort, Texas.	Laramie, Fort, Wyo.	McHenry, Fort, Md.		

State weather services from which meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for January, 1887.

Alabama Weather Service, under direction of P. H. Mell, Jr., Auburn, Alabama.
Arkansas Weather Service, under direction of Mr. George R. Brown, Little Rock, Arkansas.
Illinois Weather Service, under direction of Col. Charles F. Mills, Springfield, Illinois.
Indiana Weather Service, under direction of Prof. H. A. Huston, La Fayette, Indiana.
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